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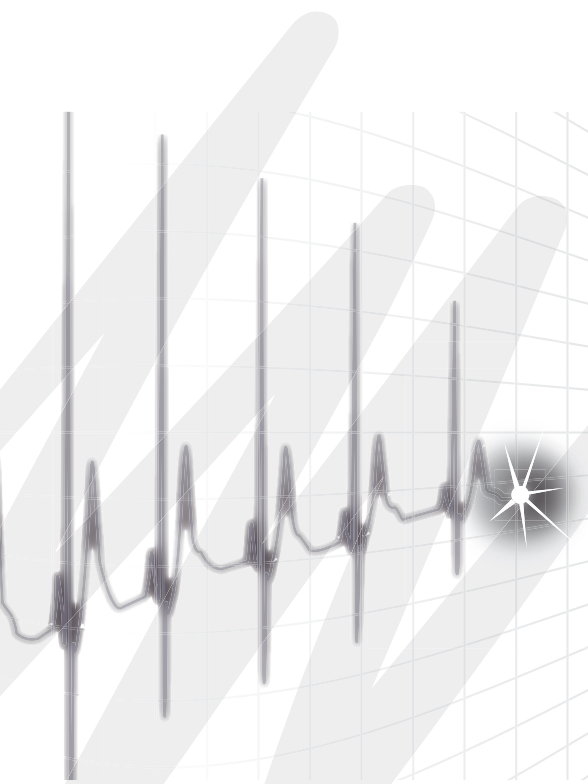

# MA3300 Audio Monitor

## Owner's Guide

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Product: MA3300 Audio Monitor

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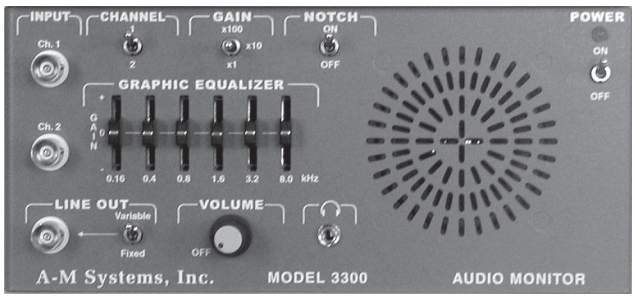
# General Description




## Instrument Features

The *Model 3300 Audio Monitor* is a high quality audio amplifier designed to transform electrophysiological signals into sounds. This amplifier features a built-in 6-band audio equalizer that enables the user to tailor the audio performance to their personal satisfaction, a high-fidelity quality speaker, a dedicated notch filter designed to minimize noise interference generated by power lines, a headphone jack, and an BNC line out jack that enables the the Model 3300 to be used as another signal amplifier prior to subsequent processing by other instruments.

The instrument can be placed on a lab bench with its built-in metal stand, or it can be mounted in any industry standard equipment rack (with included rack-mounting hardware). In addition, the instrument is shipped with it's own desktop power supply.

It can be used in a number of research or teaching applications requiring the audio reproduction of electrophysiological signals, such as such as nerve, muscle (EMG), EEG, EKG, and ERG recordings.

**The instrument is not intended for clinical measurements using humans.**

Two input signals can be passed to the *Model 3300.* A toggle switch selects which of the two signals will be amplified and processed by the 6-band equalizer. The Equalizer is a tunable filter that can increase or decrease the gain of particular frequency ranges, resulting in a pleasing sound quality produced at the speaker. The use of a set of headphones (by utilizing the mini-headphone jack) will disable the internal audio speaker. The volume control acts as a variable gain amplifier, and adjusts the volume of the speaker output. The processed signal can be passed to an oscilloscope or other instruments via the Signal Out BNC jack.

| | |
|---|---|
| ⚠ DANGER | This alerts the user to imminent death or serious injury arising from misuse of the stimulator. |
| ⚠ WARNING | This alerts the user to possible death or serious injury arising from misuse of the stimulator. |
| ⚠ CAUTION | This alerts the user to possible injury or damage to property arising from misuse of the stimulator. |

Notes are also provided in this manual to alert the user to specific instructions or recommendations.

## General

⚠ WARNING

This device is designed for experimental and research applications and must not be used for therapeutic purposes.

## Precautions regarding settings

⚠ CAUTION

Always use the supplied 3-pin cable for the power cable.
If any other power cable is used, it may result in an electric shock to the operator.

⚠ CAUTION

Do not touch the connector pins. Discharge electrostatic energy by touching a grounded metal part before connecting. The instrument may be damaged by electrostatic energy.

⚠ CAUTION

If this instrument is connected to other peripheral devices, be sure that they are connected in the manner specified by the manufacturer.
Only connect devices specified by the manufacturer.
Connection to non-specified devices may result in electric shock to the operator by current of leakage.

## Precautions regarding maintenance

⚠ CAUTION

When maintaining (cleaning, sterilizing, etc.) the stimulator, be sure to turn the power off and unplug the power cable from the power outlet first.
Failure to do so may result in an electric shock or malfunction.

⚠ CAUTION

The electronic stimulator has a high voltage output capacity of up to ±50 V.
Directly touching the output terminals or electrodes during stimulation or when the power cord is connected during inspection and the stimulator is operable may result in electric shock.

## GENERAL HANDLING PRECAUTIONS

This device is intended for use only by qualified medical personnel.
Use only our approved products with this device. Use of non-approved products or in a non-approved manner may affect the performance specifications of the device. This includes, but is not limited to, batteries, recording paper, pens, extension cables, electrode leads, input boxes and AC power.

**Please read these precautions thoroughly before attempting to operate the instrument.**

1. **To safely and effectively use the instrument, its operation must be fully understood.**

2. **When installing or storing the instrument, take the following precautions:**
   (1) Avoid moisture or contact with water, extreme atmospheric pressure, excessive humidity and temperatures, poorly ventilated areas, and saline or sulphuric air.
   (2) Place the instrument on an even, level floor. Avoid vibration and mechanical shock, even during transport.
   (3) Avoid placing in an area where chemicals are stored or where there is danger of gas leakage.
   (4) The power line source to be applied to the instrument must correspond in frequency and voltage to product specifications, and have sufficient current capacity.
   (5) Choose a room where a proper grounding facility is available.

3. **Before Operation**
   (1) Check that the instrument is in perfect operating order.
   (2) Check that the instrument is grounded properly.
   (3) Check that all cords are connected properly.
   (4) Pay extra attention when the instrument is combined with other instruments to avoid misdiagnosis or other problems.

4. **During Operation**
   (1) The instrument must receive continual, careful attention.
   (2) Turn power off or remove electrodes and/or transducers when necessary to assure the safety.

5. **To Shutdown After Use**
   (1) Turn power off with all controls returned to their original positions.
   (2) Remove the cords gently; do not use force to remove them.
   (3) Remove the power cord from the AC SOURCE socket to isolate the instrument from the AC supply mains.
   (4) Clean the instrument together with all accessories for their next use.

6. **The instrument must receive expert, professional attention for maintenance and repairs. When the instrument is not functioning properly, it should be clearly marked to avoid operation while it is out of order.**

7. **The instrument must not be altered or modified in any way.**

8. **Maintenance and Inspection:**
   (1) The instrument and parts must undergo regular maintenance inspection at least every 6 months.
   (2) If stored for extended periods without being used, make sure prior to operation that the instrument is in perfect operating condition.
   (3) Technical information such as parts list, descriptions, calibration instructions or other information is available for qualified user technical personnel upon request from your distributor.

**CAUTION**

**United States law restricts this device to sale by or on the order of a physician.**

## EMC RELATED CAUTION

**This equipment and/or system complies with the International Standard IEC 60601-2 for electromagnetic compatibility for medical electrical equipment and/or system. However, an electromagnetic environment that exceeds the limits or levels stipulated in IEC 60601-1-2, can cause harmful interference to the equipment and/or system or cause the equipment and/or system to fail to perform its intended function or degrade its intended performance. Therefore, during the operation of the equipment and/or system, if there is any undesired deviation from its intended operational performance, you must avoid, identify and resolve the adverse electromagnetic effect before continuing to use the equipment and/or system.**

**The following describes some common interference sources and remedial actions:**

1. **Strong electromagnetic interference from a nearby emitter source such as an authorized radio station or cellular phone:**
   **Install the equipment and/or system at another location. Keep the emitter source such as cellular phone away from the equipment and/or system, or turn off the cellular phone.**

2. **Radio-frequency interference from other equipment through the AC power supply of the equipment and/or system:**
   **Identify the cause of this interference and if possible remove this interference source. If this is not possible, use a different power supply.**

3. **Effect of direct or indirect electrostatic discharge:**
   **Make sure all users and patients in contact with the equipment and/or system are free from direct or indirect electrostatic energy before using it. A humid room can help lessen this problem.**

4. **Electromagnetic interference with any radio wave receiver such as radio or television:**
   **If the equipment and/or system interferes with any radio wave receiver, locate the equipment and/or system as far as possible from the radio wave receiver.**

5. **Interference of lightning:**
   **When lightning occurs near the location where the equipment and/or system is installed, it may induce an excessive voltage in the equipment and/or system. In such a case, use an uninterruptible power supply.**

6. **Use with other equipment:**
   **When the equipment and/or system is adjacent to or stacked with other equipment, the equipment and/or system may affect the other equipment. Before use, check that the equipment and/or system operates normally with the other equipment.**

7. **Use of unspecified accessory, transducer and/or cable:**
   **When an unspecified accessory, transducer and/or cable is connected to this equipment and/or system, it may cause increased electromagnetic emission or decreased electromagnetic immunity. The specified configuration of this equipment and/or system complies with the electromagnetic requirements with the specified configuration. Only use this equipment and/or system with the specified configuration.**

**Caution - continued**

8. **Use of unspecified configuration:**
   **When the equipment and/or system is used with the unspecified system configuration different than the configuration of EMC testing, it may cause increased electromagnetic emission or decreased electromagnetic immunity. Only use this equipment and/or system with the specified configuration.**

9. **Measurement with excessive sensitivity:**
   **The equipment and/or system is designed to measure bioelectrical signals with a specified sensitivity. If the equipment and/or system is used with excessive sensitivity, artifact may appear by electromagnetic interference and this may cause mis-diagnosis. When unexpected artifact appears, inspect the surrounding electromagnetic conditions and remove this artifact source.**

**If the above suggested remedial actions do not solve the problem, consult your distributor for additional suggestions.**

---

## NOTE about Waste Electrical and Electronic Equipment (WEEE) directive 2002/96/EEC

**For the member states of the European Union only:**
**The purpose of WEEE directive 2002/96/EEC is, as a first priority, the prevention of waste electrical and electronic equipment (WEEE), and in addition, the reuse, recycling and other forms of recovery of such waste so as to reduce the disposal of waste.**
**Contact your representative for disposal at the end of its working life.**

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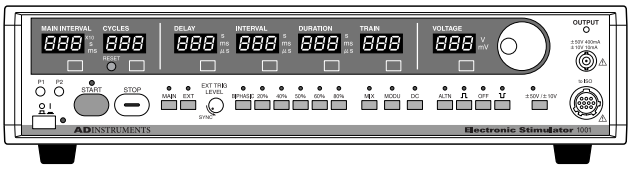
# Introduction

The electronic stimulator is used for the basic physiological and pharmacological research and experiments.

> ⚠ WARNING
>
> This device is designed for experimental and research applications and must not be used for therapeutic purposes.

By simple operation of the panel, a single pulse, pair pulse, train pulse and repeat pulse according to main interval can be output, as well as various mixed waveforms in combination with an external signal, and a biphasic pulse.

The stimulator is also equipped with a booster amplifier to allow field stimulation.




## Features

- Simple train stimulation

  A single pulse, pair pulse or train pulse can easily be output.
- Built-in main interval function, independent of stimulation waveform setup

  Starting/Stopping and the repeat time and repeat count can be set separately using the main interval function, ensuring simple, reliable operation.
- Field stimulation

  The built-in booster amplifier with a maximum output of ±50 V and 400 mA enables direct field stimulation with any stimulation waveform.
- Simple biphasic pulse stimulation
- Mixing and modulation input terminals that allow output of mixed and modulated waves through combination with an external signal
- Alternate stimulation by the addition of an evoked response to eliminate stimulation artifacts
- Output of information to an external device such as a Power Lab

  All set stimulation conditions and operating information can be output from the USB port to an external device.
- High precision, high reliability design

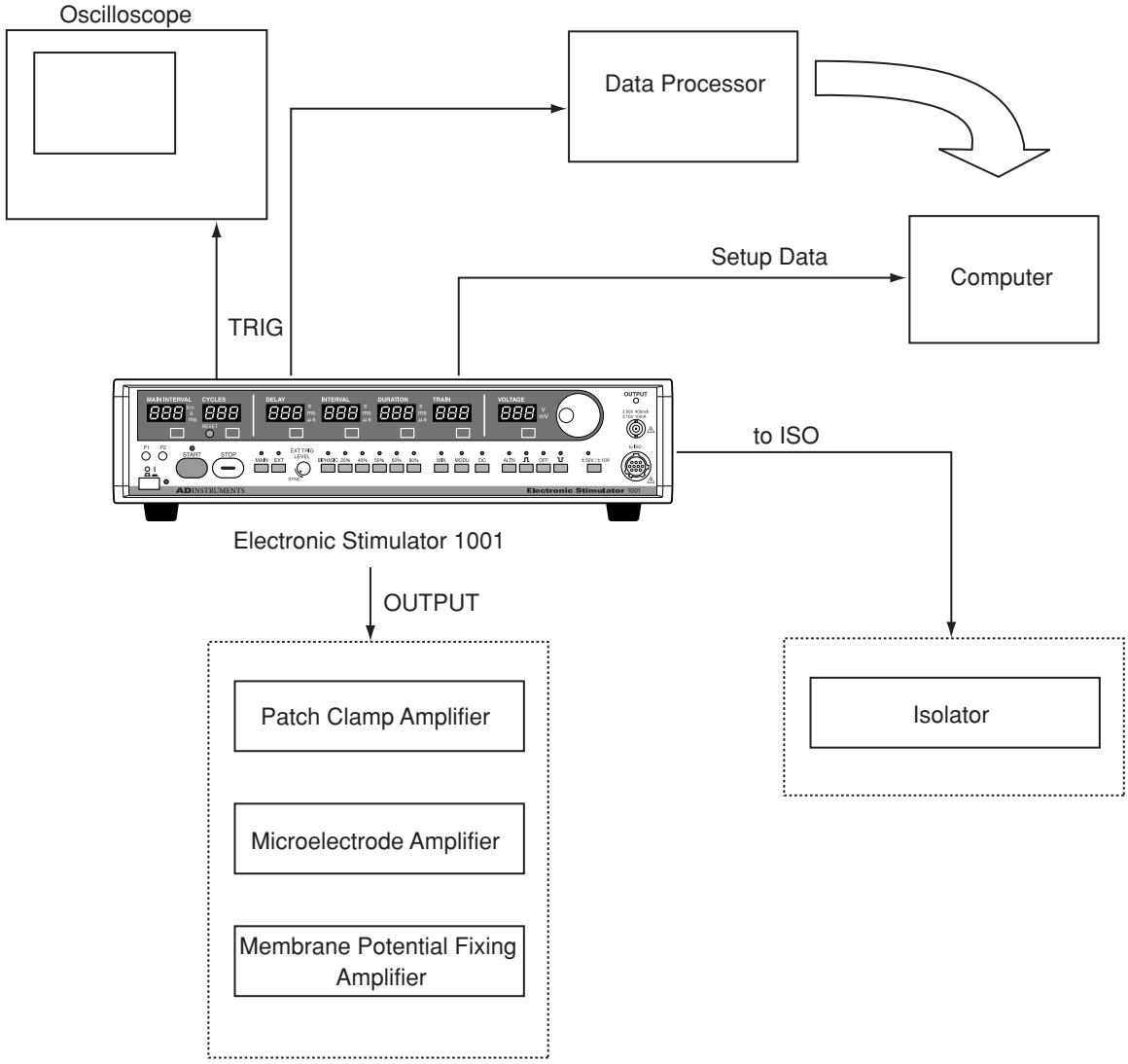
  By adopting a crystal oscillator as the internal base oscillation source and combined with IC technology, time-related items can be controlled with extreme precision, ensuring excellent reliability and reproducibility as well as stable operation.
- Fine adjustment of output voltage

  The output voltage setting can be adjusted up to 10 V.
- Input/Output protection circuit

  The built-in protection circuit prevents damage in the event of an accidental short circuit in the output terminal or synchronization signal output terminal or excessive voltage (max. 50 V) to the input terminal.

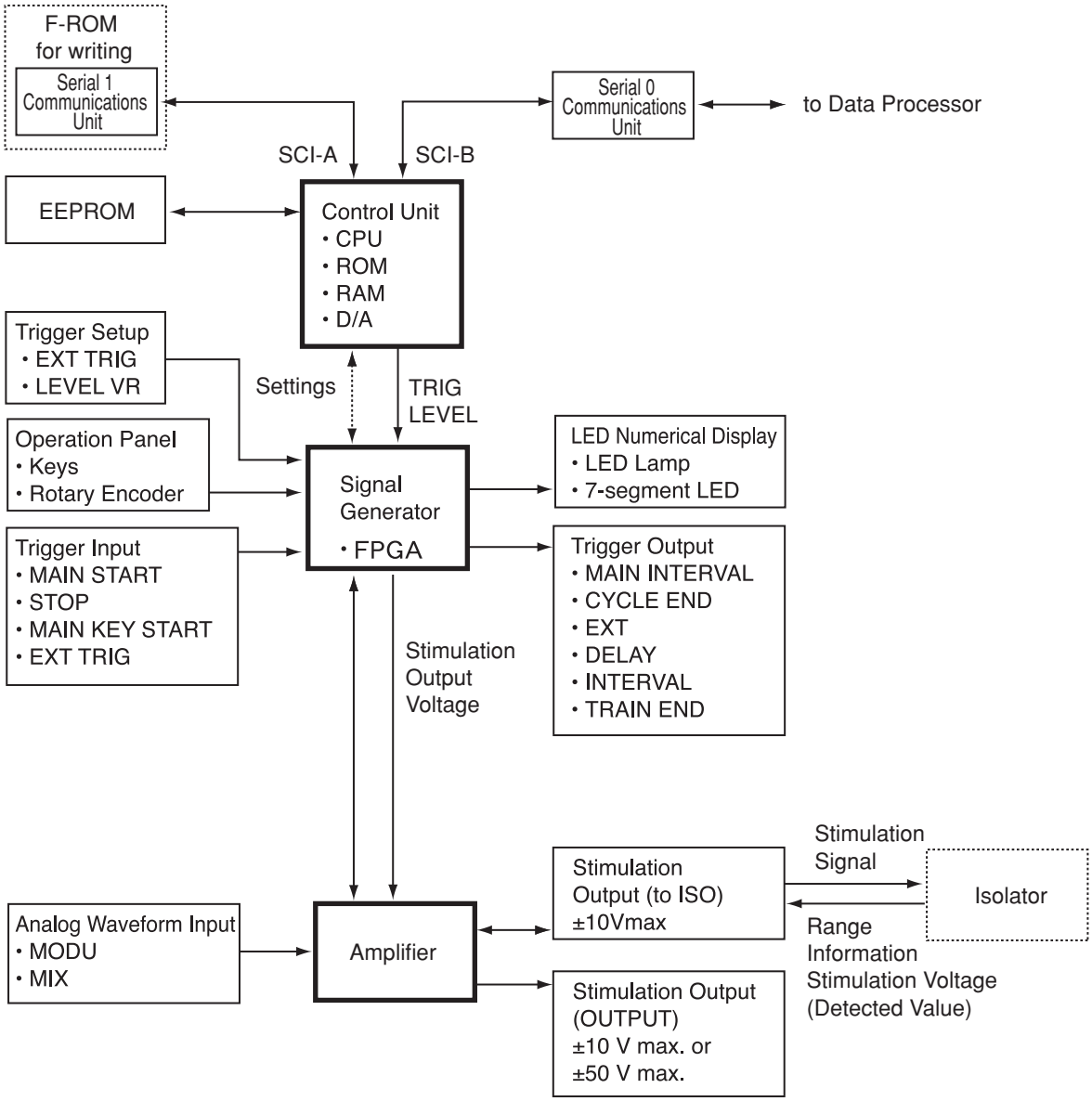
## Configuration

### Peripheral Devices




[Fig.1]

Electronic Stimulator 1001 Hardware Configuration




[Fig.2]

# Precautionary Labels and Indications

See the relevant reference page for details of each label or indication.

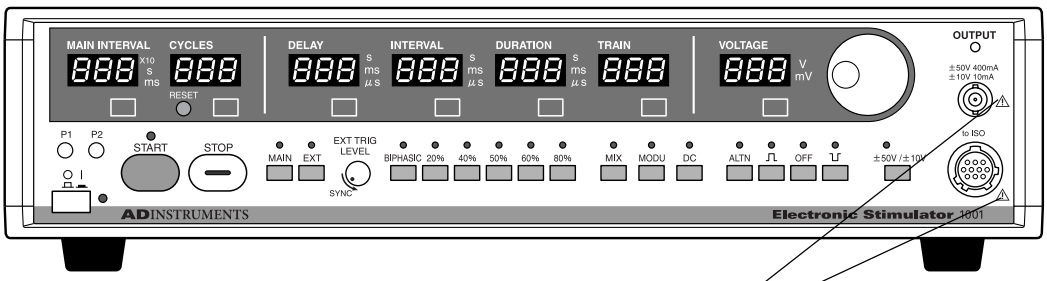
**⚠ CAUTION**

If this instrument is connected to other peripheral devices, be sure that they are connected in the manner specified by the manufacturer.
Only connect devices specified by the manufacturer.
Connection to non-specified devices may result in electric shock to the operator by current of leakage.

**⚠ CAUTION**

Do not touch the connector pins. Discharge electrostatic energy by touching a grounded metal part before connecting. The instrument may be damaged by electrostatic energy.

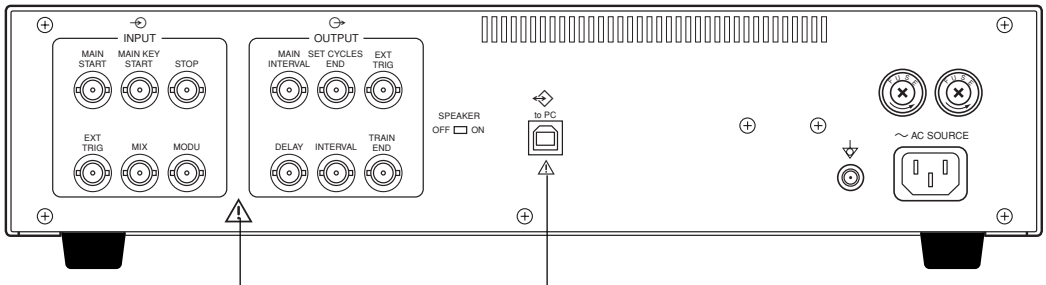
## Front




See P.1-14

[Fig.3]

## Rear




See P.1-20, 1-22

See P.1-23

[Fig.4]

# List of Symbols

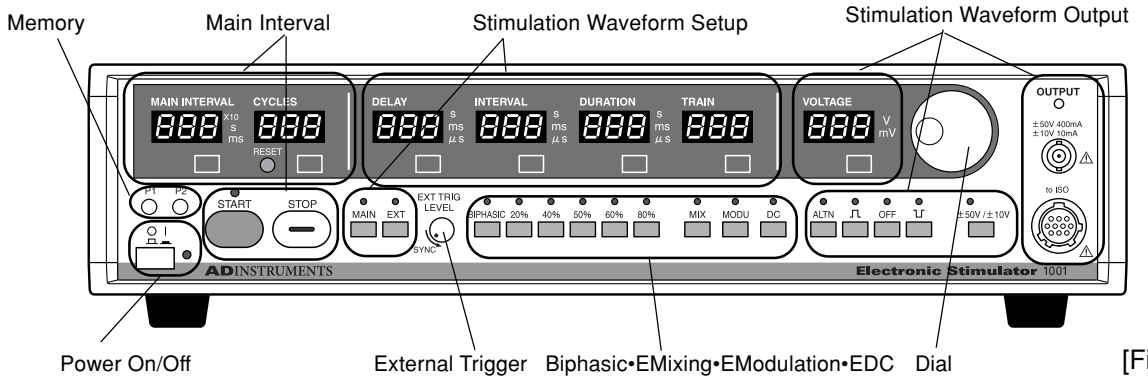
The following symbols are used in connection with the stimulator.
An explanation of each symbol is given in the table below.

* When the description of a symbol used for the stimulator differs from JIS standards, it is shown in brackets.

| Symbol | Description | Symbol | Description |
|---|---|---|---|
| | Caution / See attached materials | | [Serial I/O Terminal] |
|  | Power ON | | Input [Terminal] |
| | Power OFF | | Output [Terminal] |
|  | ON position [Power ON] | | Equipotential Ground [Terminal] |
| | OFF position [Power OFF] | | [Positive Polarity] |
| | Alternative Current (AC) | | [Negative Polarity] |
| | The products marked with this symbol apply to the European WEEE directive 2002/96/EEG and require separate waste collection. For the products labeled with this symbol, contact your representative for disposal at the end of its working life. | | |

# Description of Parts

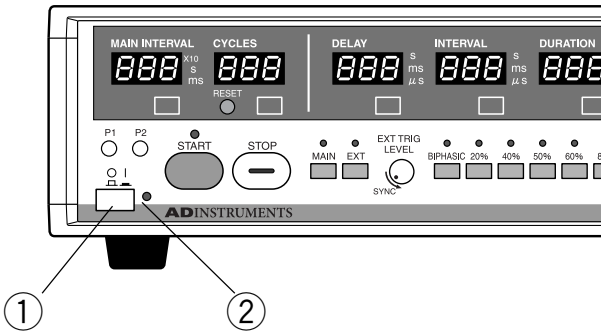
## Front




[Fig.5]

### Power On/Off

This button is used to turn the power on and off.

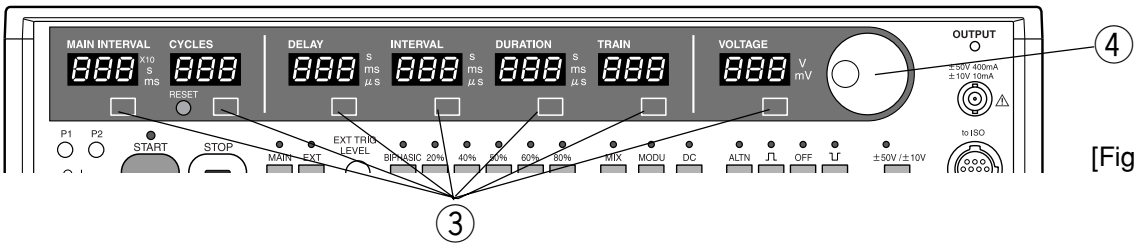



[Fig.6]

| Name | Function |
|---|---|
| ① Power Button<br>② Power Indicator Lamp | When the power button is pressed (ON position), the power indicator lamp lights and the power is turned on. To turn the power off, press the button again. When the power is turned on, all the LEDs light once (self-check). |

### Keys and Dial

Used to increase or decrease the set values. (See P.2 for details.)

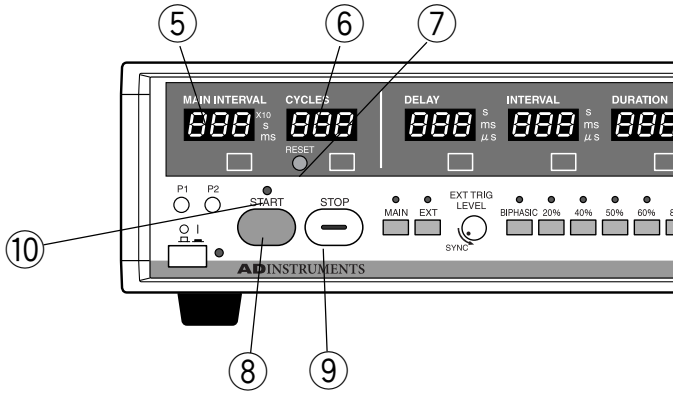



[Fig.7]

| Name | Function |
|---|---|
| ③ Keys | Press to adjust the set values. The indicator for the selected key blinks. The set value changes each time the key is pressed. |
| ④ Dial | Adjusts the set value selected with the selector key. Turn clockwise to increase the value and counterclockwise to decrease the value.<br>When the dial is pressed, the last selected set value blinks and is set. |

## Main Interval

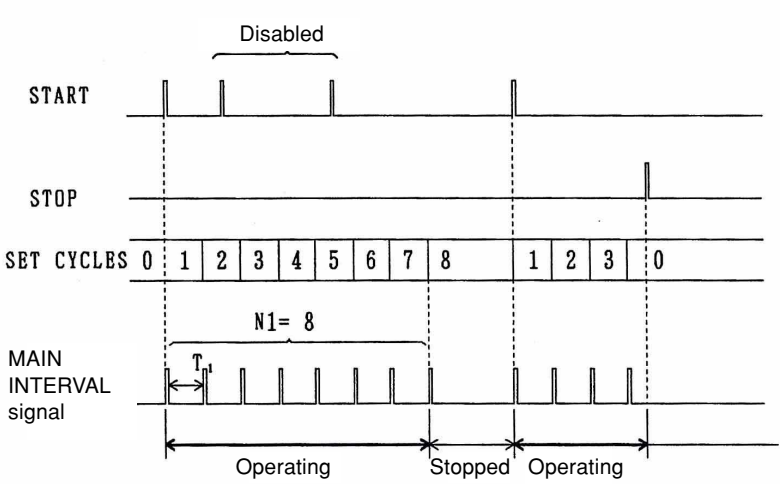
Controls the repeat cycle (T1) and repeat count (N1) as well as starting and stopping of stimulation.
(The timing signal created here acts becomes the trigger as MAIN INTERVAL and is not a direct stimulation waveform.)




[Fig.8]

| Name | Function |
|---|---|
| ⑤ Stimulation interval (T1) indicator (MAIN INTERVAL) | Displays the repeat interval (T1) setting.<br>Setting range: 1 ms to 9990 s |
| ⑥ Stimulation count indicator (CYCLES) | Displays the repeat count (N1) setting.<br>• CYCLES switches from displaying the repeat count (CYCLES) to displaying the repeat setting (SET CYCLES). (Normally CYCLES is displayed and the indicator is lit.)<br>• When the selector key is pressed, the display changes to SET CYCLES and the indicator blinks. (It automatically returns to CYCLES after about 10 seconds.)<br>• SET CYCLES can be changed by turning the dial while the indicator is blinking.<br>• While CYCLES is displayed, it is synchronized with stimulation output and shows the stimulation count.<br>Setting range: 1 to 999 or to continuous operation (run).<br>When the START signal is received, the set number of pulses is output by MAIN INTERVAL at the set interval (T1) and operation stops.<br>When continuous operation is set (run), after the START signal is received, the MAIN INTERVAL signal continues to be sent at the set interval (T1).<br>Operation continues until the STOP key is pressed. |
| ⑦ Stimulation count cancel key (RESET) | Resets the stimulation repeat count. |
| ⑧ Stimulation start key (START <MANUAL>) | Used to start stimulation manually.<br>When this key is pressed, MAIN INTERVAL operation Starts.<br>The START key is disabled during MAIN INTERVAL operation. (No restart.) |
| ⑨ Stimulation stop key (STOP <MANUAL>) | Used to stop stimulation manually.<br>When this key is pressed, MAIN INTERVAL and all other operation stops and the stimulator returns to initial status. |

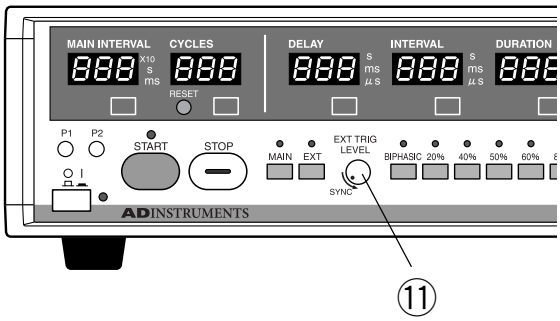
| Name | Function |
|---|---|
| ⑩ MAIN INTERVAL operation lamp | Lights when MAIN INTERVAL is operating.<br>(As it is sometimes difficult to tell whether MAIN INTERVAL is operating when a long interval has been set, operation can be judged by checking the lamp.) |




[Fig.9] MAIN INTERVAL operation when SET CYCLES is set to 008

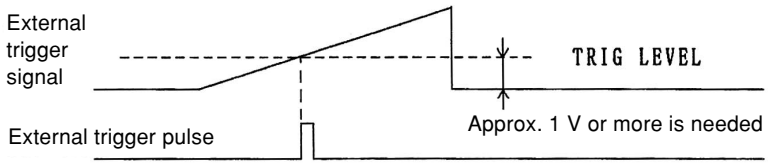
External Trigger (EXT TRIG)

Like MAIN INTERVAL, this generates a trigger pulse. It is used to control the stimulation repeat cycle by an external signal.
When EXT is selected with the trigger selector button, stimulation occurs in synchronization with the signal that is input to the external trigger terminal on the rear of the stimulator.




[Fig.10]

| Name | Function |
|---|---|
| ⑪ Trigger level adjustment knob (EXT TRIG LEVEL) | Selects whether the trigger is activated at the signal level that is input to the external trigger terminal (on rear).<br>Adjustment range: 0 to ±10 V.<br><br>If the sweep-wave output from the oscilloscope is used as the external trigger signal, the stimulation pulse can be monitored at any position on the oscilloscope tube by setting the level adjustment knob.<br>Allowing for a noise margin and hysteresis in the built-in comparator, use a trigger signal to oscillate up to about 1 V lower than the trigger level. |




[Fig.11]

When set to SYNC

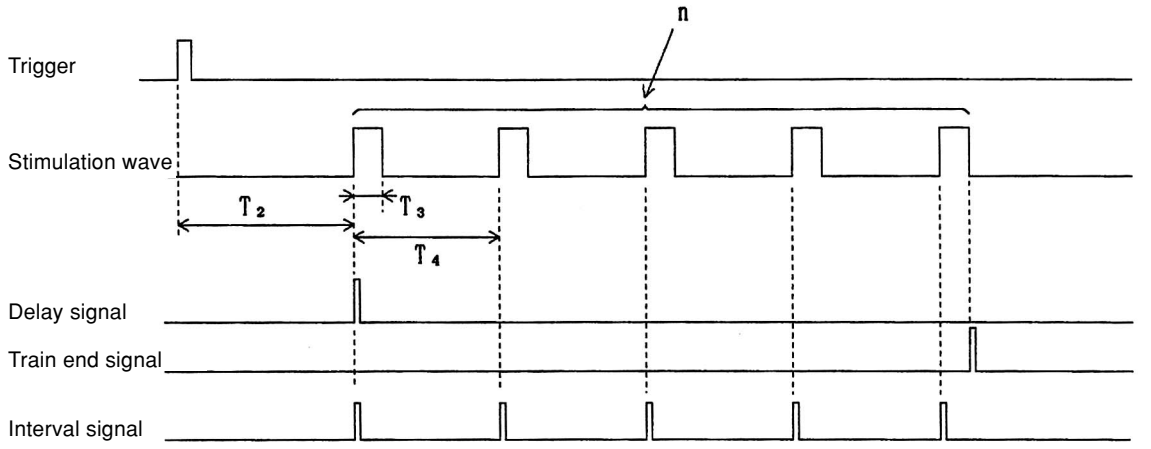
When the knob is turned fully counterclockwise until it locks (SYNC position), the trigger level is approximately +3 V.

When activating the trigger at a pulse of +5 V, the inconvenience of setting the level can by avoided by using this position.

## Stimulation Waveform Setup

This component receives the main interval trigger signal, external trigger signal, etc., sets the stimulation wave and timing and sends the signal for stimulation output.

The stimulation wave is determined by the four parameters in the figure below.



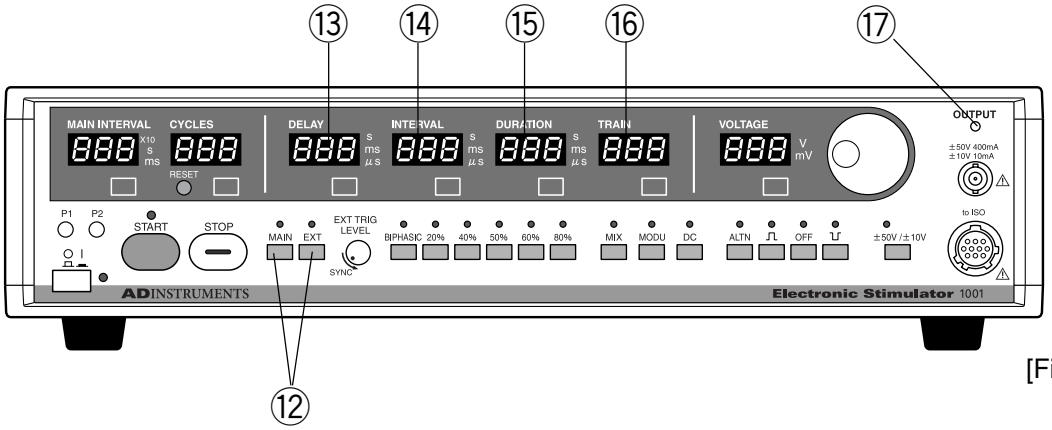

[Fig.12]

T2 = DELAY: delay time from trigger to start of stimulation

T3 = DURATION: duration of stimulation pulse

T4= INTERVAL: interval between stimulation pulses

n = TRAIN: number of stimulation pulses




[Fig.13]

| Name | Function |
|---|---|
| ⑫ Trigger signal selector key (MAIN, EXT) | Selects a trigger signal. The lamp for the selected key lights.<br>MAIN: Signal generated by MAIN INTERVAL described above<br>EXT: Signal generated by EXTERNAL TRIGGER described above |
| ⑬ Delay time display (DELAY) | Sets the delay time (T2) until the channel outputs a stimulation pulse after the trigger signal is received. The timing is shown in Fig.12. |

| Number | Setting range | Unit |
|---|---|---|
| 3 digits | 0-99.9 sec | s, ms, μs |

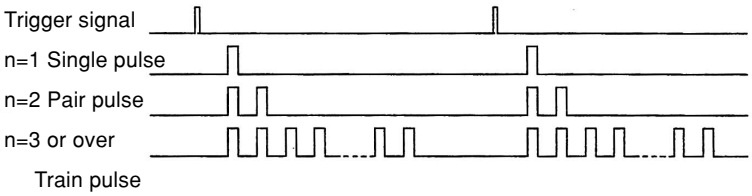
| | |
|---|---|
| ⑭ Stimulation pulse interval display (INTERVAL) | Sets the pulse interval (T4) when the number of stimulation pulses is set by TRAIN to 2 pulses or more or to continuous stimulation (run). The timing is shown in Fig.12. |

| Number | Setting range | Unit |
|---|---|---|
| 3 digits | 100 μsec to 999 sec | s, ms, μs |

| | |
|---|---|
| ⑮ Stimulation pulse duration display (DURATION) | Sets the stimulation pulse duration (T3). The timing is shown in Fig.12. |

| Number | Setting range | Unit |
|---|---|---|
| 3 digits | 10 μsec to 99.9 sec | s, ms, μs |

| | |
|---|---|
| ⑯ Stimulation pulse count display (TRAIN) | Sets the number (n) of stimulation pulses.<br>Fig.12 shows an example when n=5.<br>Setting range: 0 to 999.<br>Single pulse stimulation occurs at n=001, pair pulse stimulation at n=002 and train pulse stimulation at n=003 or over. |



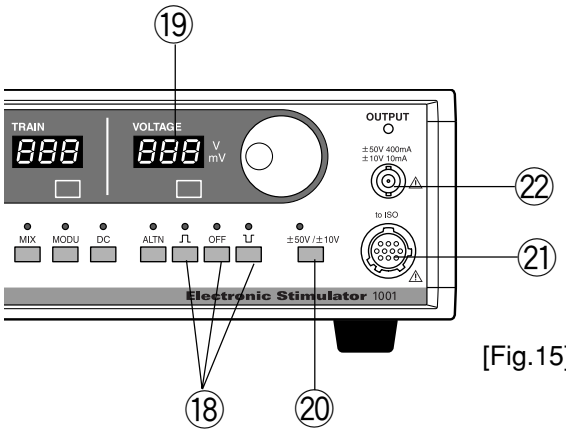

[Fig.14]

When run (set value: 000) is set, continuous stimulation occurs. After the trigger is initiated and the delay time has elapsed, pulse output continues at the set interval (T4).
Continuous stimulation continues until the STOP button is pressed.
The following trigger signals are disabled during stimulation.

| | |
|---|---|
| ⑰ Monitor lamp (OUTPUT) | Stimulation pulse monitor lamp.<br>It lights for at least 50 ms in synchronization with the stimulation pulse.<br>If the duration of the stimulation pulse is 50 ms or more, the lamp stays lit for the duration of the pulse.<br>As the purpose of the lamp is to monitor the timing of the stimulation pulse, it operates regardless of the polarity selector key, VOLTAGE setting or MIX key. |

## Stimulation Waveform Output

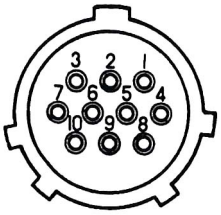
This sets the polarity of the waveform generated by stimulation waveform setup and the output voltage.




[Fig.15]

| Name | Function |
|---|---|
| ⑱ Polarity selector key (⎍, OFF, ⎏) | Switches the polarity of the stimulation pulse. ⎍ indicates positive polarity and ⎏ negative polarity.<br>The selection governs both the isolator connector and the output terminals. Output is 0 V when OFF is selected. |
| ⑲ Output voltage display (VOLTAGE) | Sets the output voltage of the stimulation waveform. Setting is performed by the same method as for other settings.<br>Normally, setting is 0 mV or from 10 mV to 10 V. If ±50 V is selected, setting is 0 mV or from 10 mV to 50 V. (1 mV to 9 mV cannot be set.)<br>This setting does not affect the mixing signal or modulation signal. DC voltage in DC mode is also set.<br>When negative polarity (⎏) is selected with the polarity selector key, it is read as it is as minus voltage. Output precision in relation to the command is within ±5% ±50 mV. |

| Name | Function |
|---|---|
| ⑳ Output selector key (±50 V / ±10 V) | When the key is pressed, the lamp lights and 5 times the normal voltage of 0 to ±10 V is supplied to the output terminal.<br>This can be used for field stimulation.<br>(max. 0 to ±50 V, 400 mA)<br>Additionally, key operation does not affect output to the isolator (to ISO connector). |
| ㉑ to ISO (Isolator output connector) | Drives the isolator when connected to the connector. |



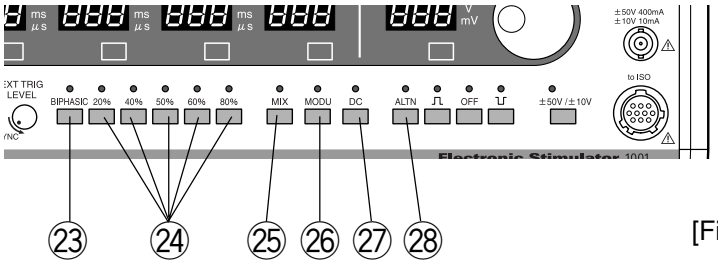

[Fig.16]

| Pin No. | Signal |
|---|---|
| 1, 2 | +15V |
| 3 | –15V |
| 4 | SIGNAL OUT |
| 5 | Range data |
| 6 | E |
| 7 | Range data synchronizing clock |
| 8, 9, 10 | Void |

| | |
|---|---|
| ㉒ Output terminal | As the output waveform is the same as that of the isolator output connector, this is useful for monitoring the stimulation waveform.<br>It can also be used for the stimulation signal to the microelectrode amplifier or membrane potential fixing amplifier .<br>However, when output is switched to ±50 V, the waveform is not the same as the isolator output connector signal, and five times the voltage is generated. Use this terminal directly for field stimulation.<br>[Note] Take care to avoid short-circuiting during stimulation, otherwise no stimulation will occur. |

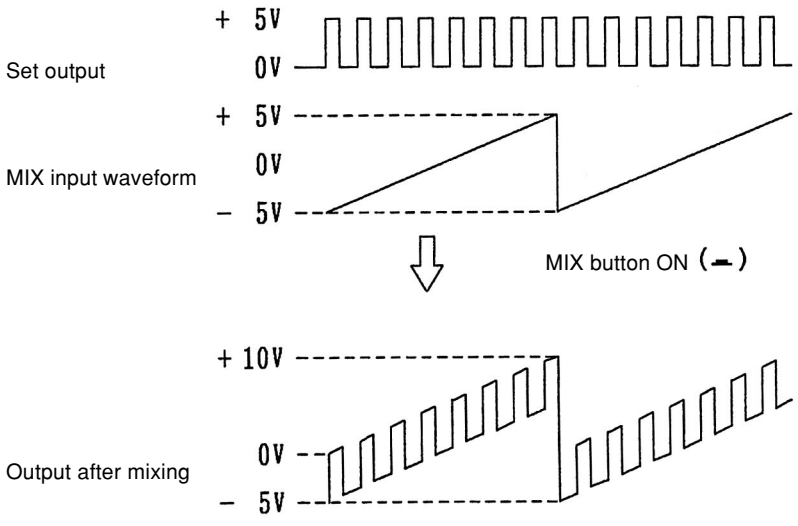
## BIPHASIC, MIX, MODU, DC, ALTN

These keys are used when stimulation is performed by biphasic wave, a composite wave created by mixing with an external waveform, a waveform where the external signal has been modulated by internal oscillation, or with DC voltage.



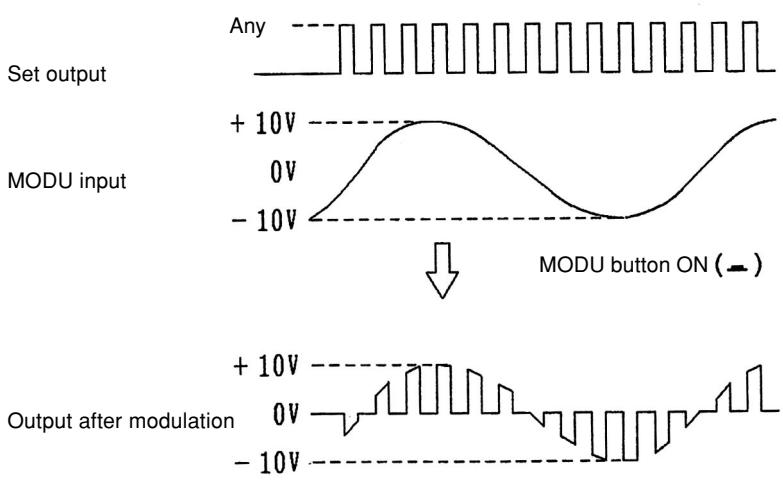

[Fig.17]

| Name | Function |
|---|---|
| ㉓ Biphasic waveform key (BIPHASIC) | Press to output a biphasic waveform. (The lamp lights.) |
| ㉔ Biphasic negative polarity voltage selector key (20%, 40%, 50%, 60%, 80%) | Selects a time percentage in relation to the value set by DURATION of the positive-polarity pulse in biphasic waveform. The set value becomes the time percentage of the positive-polarity pulse and the remaining time becomes the negative-polarity pulse.<br>The lamp for the selected key lights. |
| ㉕ Waveform mixing key (MIX) | When the MIX key is pressed, the set stimulation waveform can be combined with another waveform. (The lamp lights.)<br>Amplitude is added in units of 1. The waveform becomes distorted if the voltage after mixing exceeds a range of ±10 V. |




[Fig.18]

| Name | Function |
|---|---|
| ㉖ Waveform modulation key (MODU) | Press this key to modulate the external signal to the waveform created in stimulation waveform setup described above. (The lamp lights.) Connect the modulated signal to the MODU terminal on the rear of the stimulator. The VOLTAGE setting is disabled when this key is pressed. |



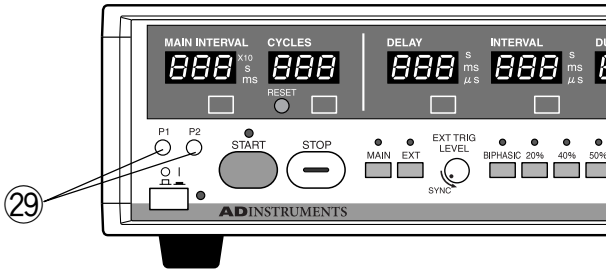

[Fig.19]

The range of the input voltage is within ±10 V. Output is modulated in the same amplitude as the input signal.

| | |
|---|---|
| ㉗ Direct current key (DC) | Press this key to create DC stimulation. (The lamp lights.) When this key is pressed, a DC signal is output, regardless of the setting or action of the stimulation waveform setup described above. The output voltage is set by VOLTAGE. When the polarity selector key is set to ⎍, plus-voltage is generated, and when it is set to ⎎, minus- voltage is generated. There is no output when set to OFF. |
| ㉘ Alternate key (ALTN) | Stimulation waveforms can be output by alternate polarity.<br>Both the isolator connector and the output terminals are affected. The polarity is not switched in relation to the MIXING or MODULATION signal. |

## Memory

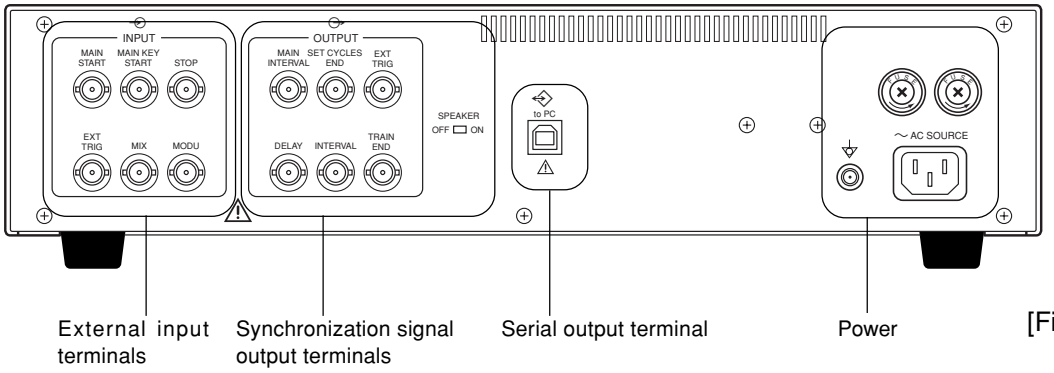
Settings can be saved for retrieval later.




[Fig.20]

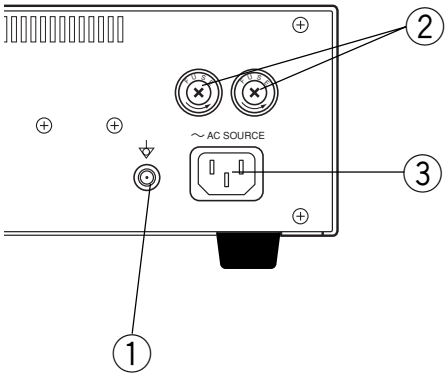
| Name | Function |
|---|---|
| ㉙ Memory keys (P1, P2) | To save the settings, press P1 or P2 for more than 2 seconds. The current settings are saved to the selected memory.<br>Pressing P1 or P2 briefly later will retrieve and apply the saved settings. |

## Rear




[Fig.21]

### Power

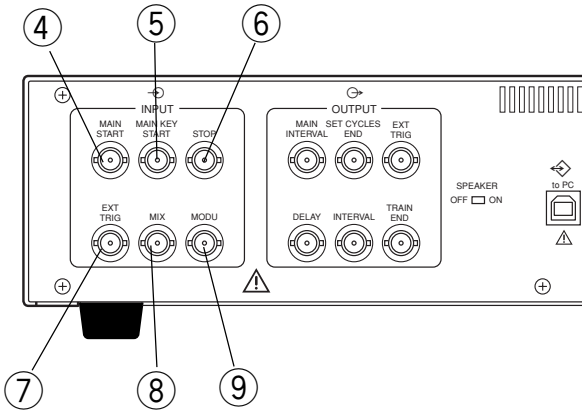



[Fig.22]

| Name | Function |
|---|---|
| ① Equipotential ground terminal | Connect the ground wires of accessory devices to ground the devices. |
| ② Fuse holder (FUSE) | Contains a time-lag fuse.<br>The fuse should only be changed by Nihon Kohden sales personnel or a qualified electrician.<br>To change the fuse, turn the "+" groove in the holder with a screwdriver, remove the fuse and insert the supplied new fuse. |
| ③ Power IN connector (AC SOURCE) | Connect the supplied power cable to supply AC power to the stimulator. |

## External Signal Input Terminals

[Note] Input the signals to the input terminals in the range specified in the input conditions. If the signal exceeds the range, it may cause failure or malfunction.




[Fig.23]

| Name | Function |
|---|---|
| ④ Main start signal input terminal (MAIN START) | Input the signal to this terminal to commence main interval operation by an external signal. It has the same function as the START button on the front panel. The input signal must be a pulse waveform of +3.5 V or over with a width of 10 μ sec or over. |
| ⑤ Main key start terminal (MAIN KEY START) | When this terminal is short-circuited to the E (Earth) terminal, MAIN INTERVAL operation commences.<br>The function is the same as the START button on the front panel. |
| ⑥ Stop signal input terminal (STOP) | Input the signal to this terminal to stop stimulation by an external signal. The function is the same as the STOP button on the front panel. The input signal conditions are the same as for START. |
| ⑦ External trigger input terminal (EXT TRIG) | Input a signal to this terminal to trigger stimulation by an external signal.<br>Setting range: 0 to +10 V.<br>(See “External trigger level knob”)<br>• Input conditions<br>Input impedance: approx. 100 kilohms<br>Allowable range of input voltage: 0 to +50 V |

| Name | Function |
|---|---|
| ⑧ Mixing signal input terminal (MIX) | Input the desired signal to this terminal to combine it with an external signal when performing stimulation.<br>The mixed signal can be obtained by pressing the MIX key on the front panel after connecting the signal.<br>• Input conditions<br>Input impedance: approx. 100 kilohms<br>Effective input voltage range: ±10 V |
| ⑨ Modulation signal input terminal (MODU) | Input the signal to this terminal to modulate the external waveform by internal oscillation. When the waveform has been modulated by the internally created pulse, it can be output by pressing the MODU key on the front panel after connecting the signal.<br>• Input conditions<br>Input impedance: approx. 100 kilohms<br>Effective input voltage range: ±10 V |

## Synchronizing Signal Output Terminal

The following signal is provided as a synchronizing signal for other devices.

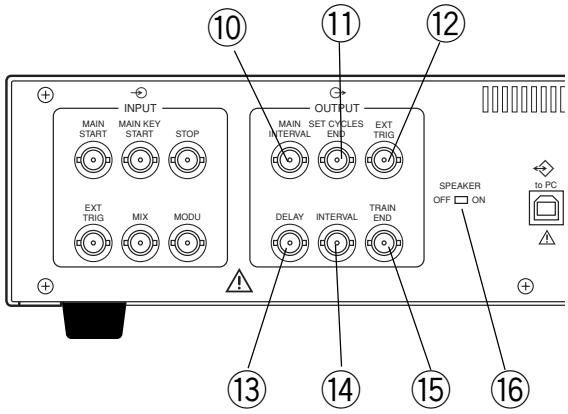
The synchronizing signal is output regardless of the MIX, MODU or DC polarity selector keys or the VOLTAGE setting.

For example, even when the DC key is pressed and no pulse is output, the END and DELAY pulses are output according to stimulation waveform setup.

Output impedance: approx. 1 kilohm

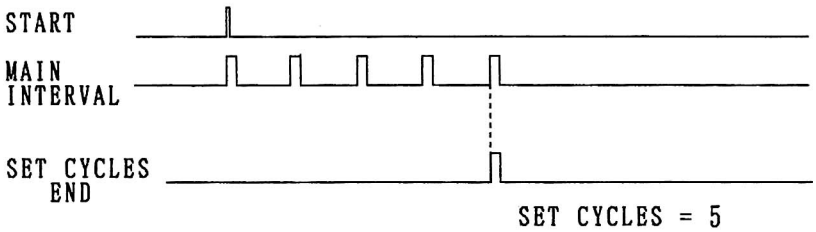
Amplitude: approx. +5 V

Pulse duration: approx. 500 μs




[Fig.24]

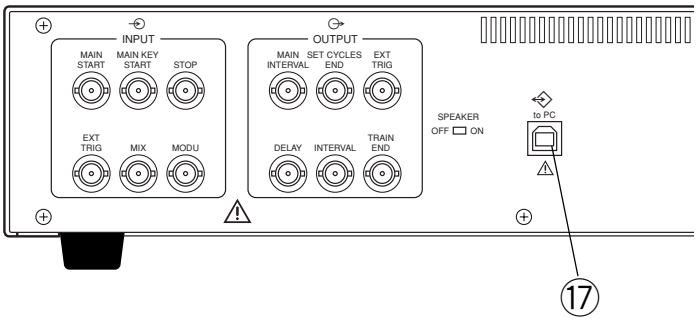
| Name | Function |
|---|---|
| Main interval output terminal (MAIN INTERVAL) | Generates a pulse that is synchronized with the MAIN INTERVAL trigger signal. |
| Set cycle end signal output (SET CYCLES END) | Generates a pulse that is synchronized with the last MAIN INTERVAL repeat pulse. When CYCLES is set to 005 and MAIN INTERVAL is started, the pulse is output at the fifth main interval. |
| External trigger output terminal (EXT TRIG) | Generates a pulse that is synchronized with the trigger signal created by the external trigger signal. |




[Fig.25]

| name | Function |
|---|---|
| Delay signal output terminal (DELAY) | Generates a pulse that is synchronized with the delay signal generated by stimulation waveform setup. (See Fig.12 for the timing.) |
| Interval signal output terminal (INTERVAL) | Generates a pulse that is synchronized with the interval. (See Fig.12 for the timing.) |
| Train end signal output terminal (TRAIN END) | Generates a pulse that is synchronized with the train end signal generated by stimulation waveform setup. (See Fig.12 for the timing.) |
| Synchronized sound on/off switch (SPEAKER ON/OFF) | Switches the synchronized sound on and off. |

## Serial Output




[Fig.26]

| Name | Function |
|---|---|
| Serial I/O terminal (to PC) | Various setup data can be sent to and from a computer. |

# General Handling Precautions

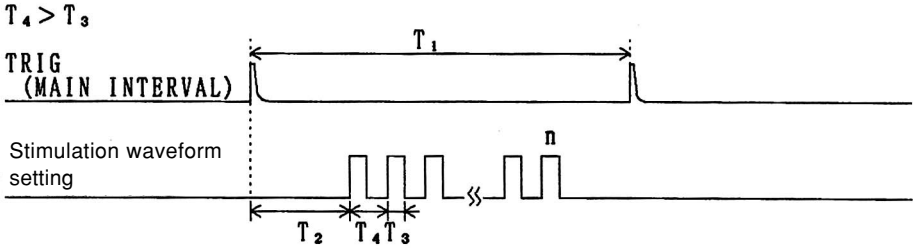
**⚠ CAUTION**

The electronic stimulator has a high voltage output capacity of up to ±50 V.
Directly touching the output terminals or electrodes during stimulation or when the power cable is connected during inspection and the stimulator is operable may result in electric shock.

1. The timing for each stimulation waveform setting is set automatically according to the following eqvation.

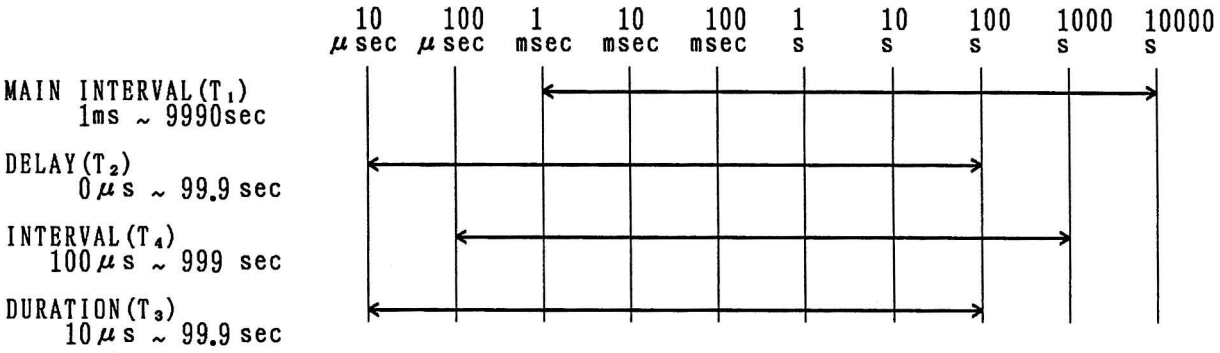
$T_1 > T_2 + T_4 \times (n-1) + T_3$

$T_4 > T_3$




[Fig.27]

Setting is performed in the order T1 > T2 > T4 > T3 > n.




[Fig.28]

2. Make sure that operation has stopped before pressing the keys. If the keys are pressed while the stimulator is operating, the new setting will be reflected in stimulator operation immediately. Care must therefore be taken as unexpected stimulation may result.

3. When all the number settings on the dial are set to 0, the following occurs.

CYCLE: Continuous stimulation (indicated as “run”)
DELAY: Delay time = 0
TRAIN: Continuous stimulation (indicated as “run”)

5. The output terminal has a short-circuit protective circuit, but avoid short-circuiting for long periods as this may adversely affect the performance of the stimulator.

6. When the power is turned on, output is momentarily unstable and a spike pulse may be generated. When stimulating, this spike may become the stimulation pulse. Turn the power on before attaching the electrodes.

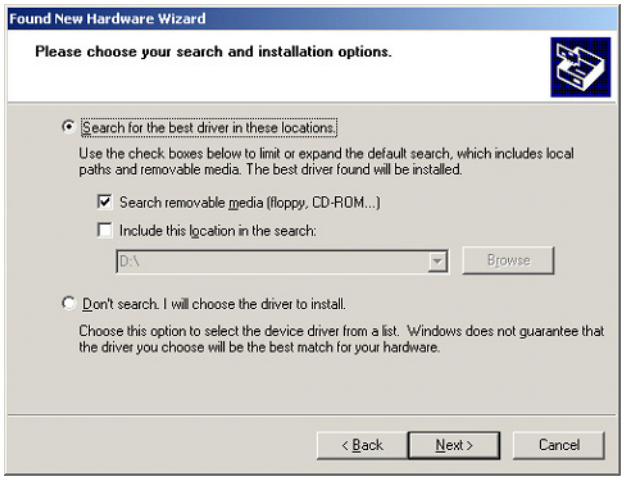
7. Do not use the stimulator with the cover on as this may cause overheating.

## Installing the Serial Converter Driver Software

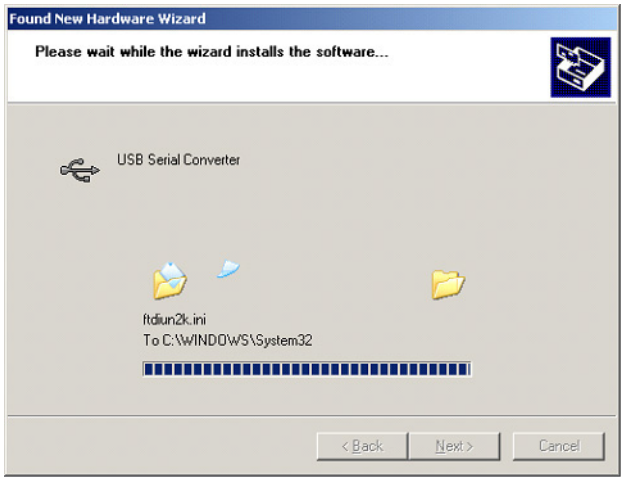
1. Turn on the PC is installed the Scope application.
   End the Scope application once while the Scope application is operating.
2. Set the CD-ROM of the driver software attached to the electronic stimulator to the CD drive of the PC.
3. Turn on the electronic stimulator.
4. Connect the electronic stimulator to the PC with the USB cable attached to the electronic stimulator.
   The New hardware detection wizard is opened.
5. Click “Install from a list or specific location (Advanced)”, and then click the Next > button.

Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
This wizard helps you install software for:
USB <-> Serial
If your hardware came with an installation CD or floppy disk, insert it now.
What do you want the wizard to do?
Install the software automatically (Recommended)
Install from a list or specific location (Advanced)
Click Next to continue.
< Back
Next >
Cancel

6. Click “Search for the best driver in these locations.”.
   Specify the CD-ROM drive, and then click the Next > button.

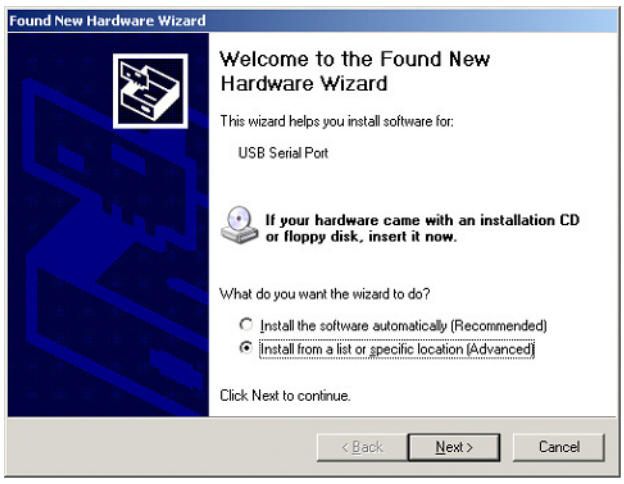

Found New Hardware Wizard
Please choose your search and installation options.
Search for the best driver in these locations.
Use the check boxes below to limit or expand the default search, which includes local paths and removable media. The best driver found will be installed.
Search removable media (floppy, CD-ROM...)
Include this location in the search:
D:\
Browse
Don't search. I will choose the driver to install.
Choose this option to select the device driver from a list. Windows does not guarantee that the driver you choose will be the best match for your hardware.
< Back
Next >
Cancel

7. Installing the USB Serial Converter driver software is started.

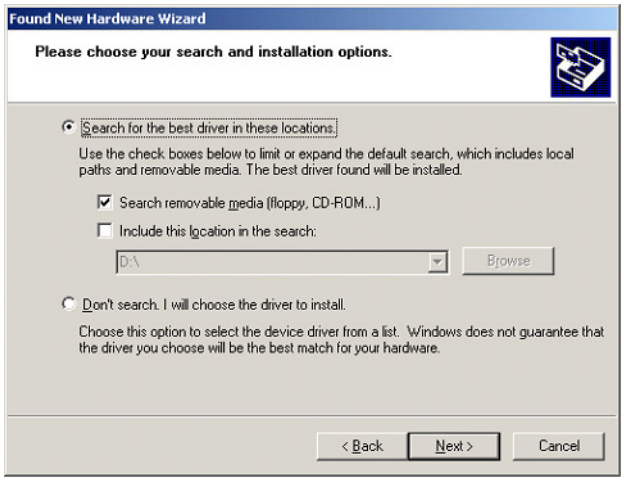



8. Click the Finish button to finish installing the USB Serial Converter driver software.
   The USB Serial Port driver software is continuously installed.

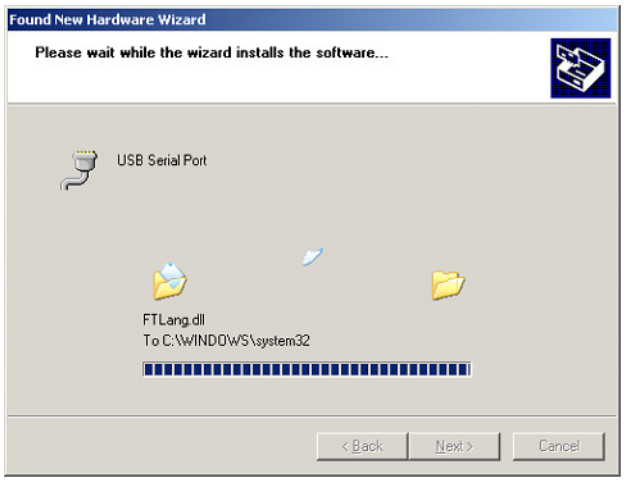
9. The following window is displayed when waiting for a while.
   Click “Install from a list or specific location (Advanced)”, and then click the Next > button.


Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
This wizard helps you install software for:
USB Serial Port
If your hardware came with an installation CD or floppy disk, insert it now.
What do you want the wizard to do?
Install the software automatically (Recommended)
Install from a list or specific location (Advanced)
Click Next to continue.
< Back
Next >
Cancel

10. Click “Search for the best driver in these locations.”.
    Specify the CD-ROM drive, and then click the Next > button.


Found New Hardware Wizard
Please choose your search and installation options.
Search for the best driver in these locations.
Use the check boxes below to limit or expand the default search, which includes local paths and removable media. The best driver found will be installed.
Search removable media (floppy, CD-ROM...)
Include this location in the search:
D:\
Browse
Don't search. I will choose the driver to install.
Choose this option to select the device driver from a list. Windows does not guarantee that the driver you choose will be the best match for your hardware.
< Back
Next >
Cancel

11. Installing the USB Serial Port driver software is started.

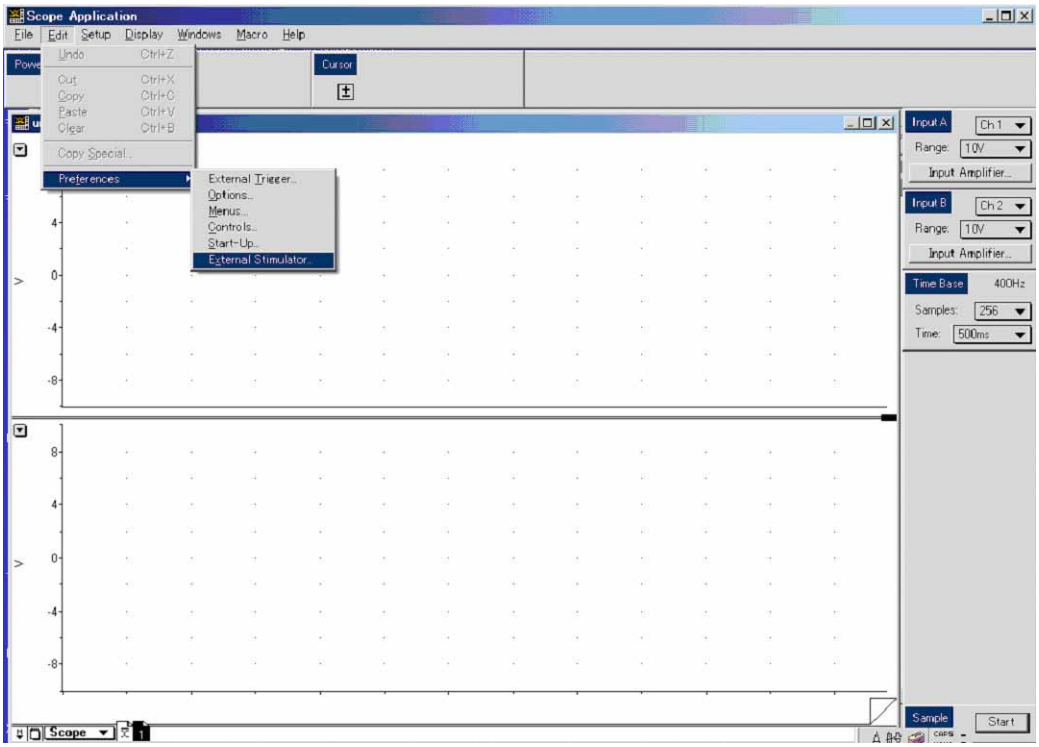



12. Click the Finish button to finish installing the USB Serial Port driver software.

## Scope Settings

1. Initial setting of the Scope (PowerLab)

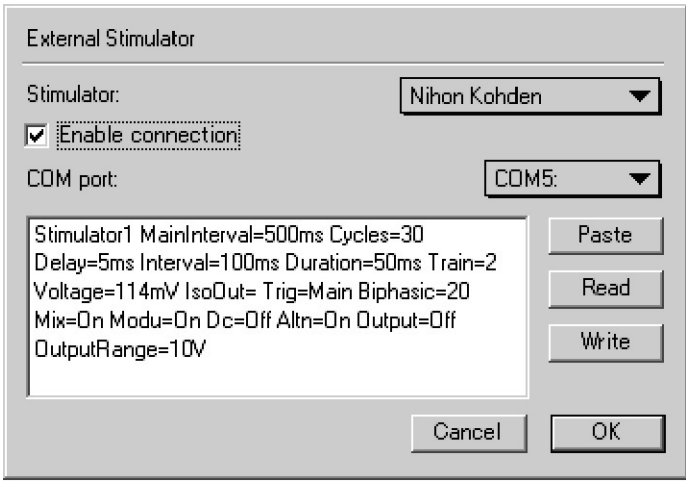
   1) Click the Preferences, and then click the External Stimulator in the Edit menu on the Scope Application. The External Stimulator window is opened.




   2) Select appropriate COM port, and check the Enable connection check box. The setting information of the electronic stimulator is displayed on the External Stimulator window.

### NOTE

When the setting information is not displayed, select COM port again after confirming the PC (installed Scope application) is connected with the electronic stimulator.

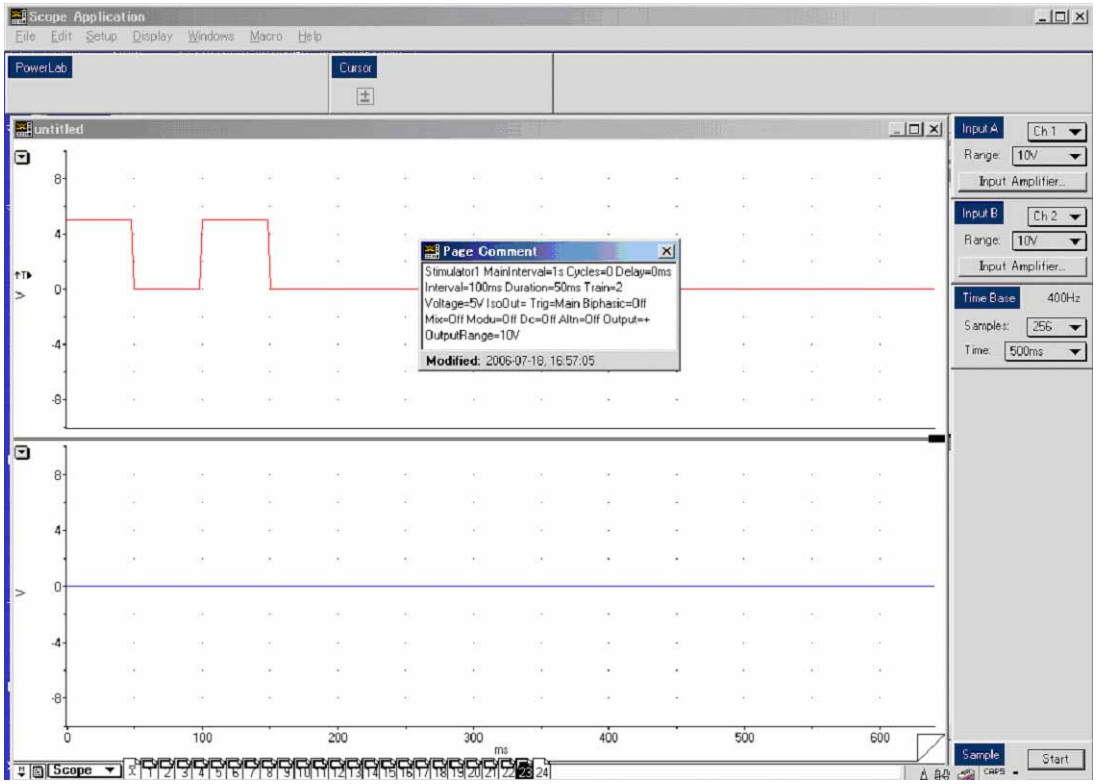


2. Taking of the setting information of the electronic stimulator into the Scope application

   The Scope begins at the same time when the START button of the electronic stimulator is pushed.

   The setting information of the electronic stimulator is taken automatically into the Page Comment window on the Scope application.

   Taken the setting information can be confirmed by opening the Page Comment window.



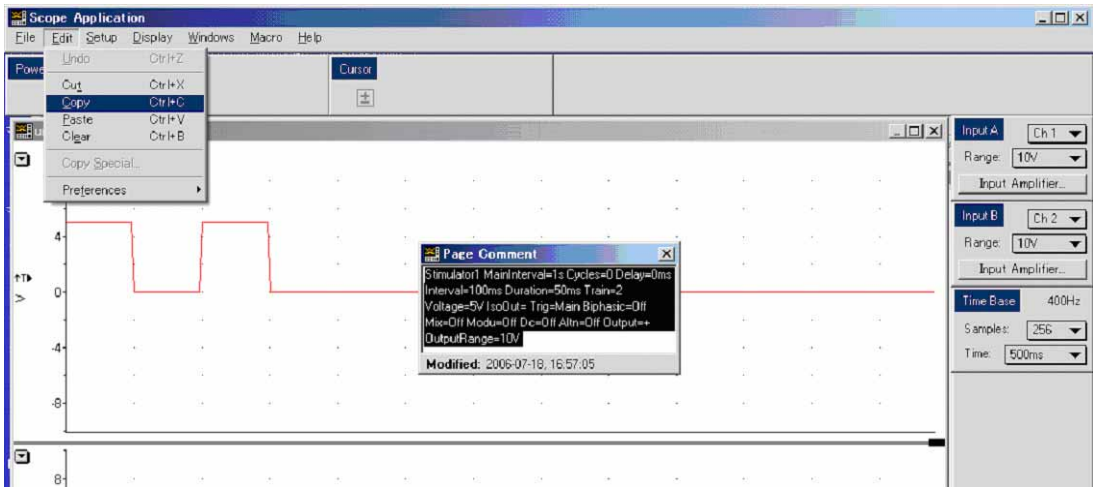
3. Setting the electronic stimulator from the Scope application

The stimulation condition of the electronic stimulator can be set by the screen operation by the Scope application.

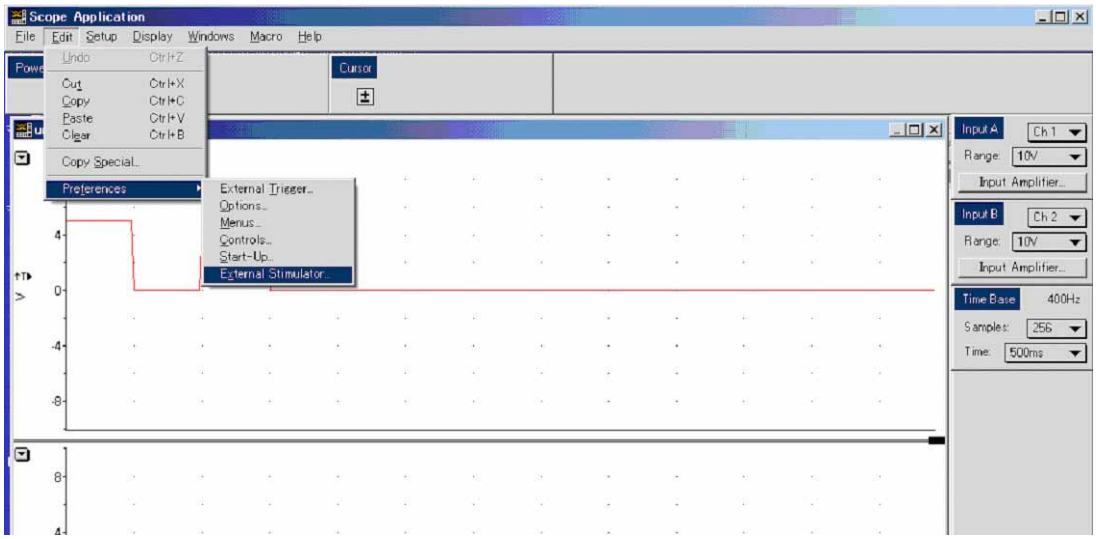
1) The Page Comment window is opened on an arbitrary screen of the Scope application, and the content is confirmed as shown in the figure below.

2) Select the displayed conditions by the drug operation.

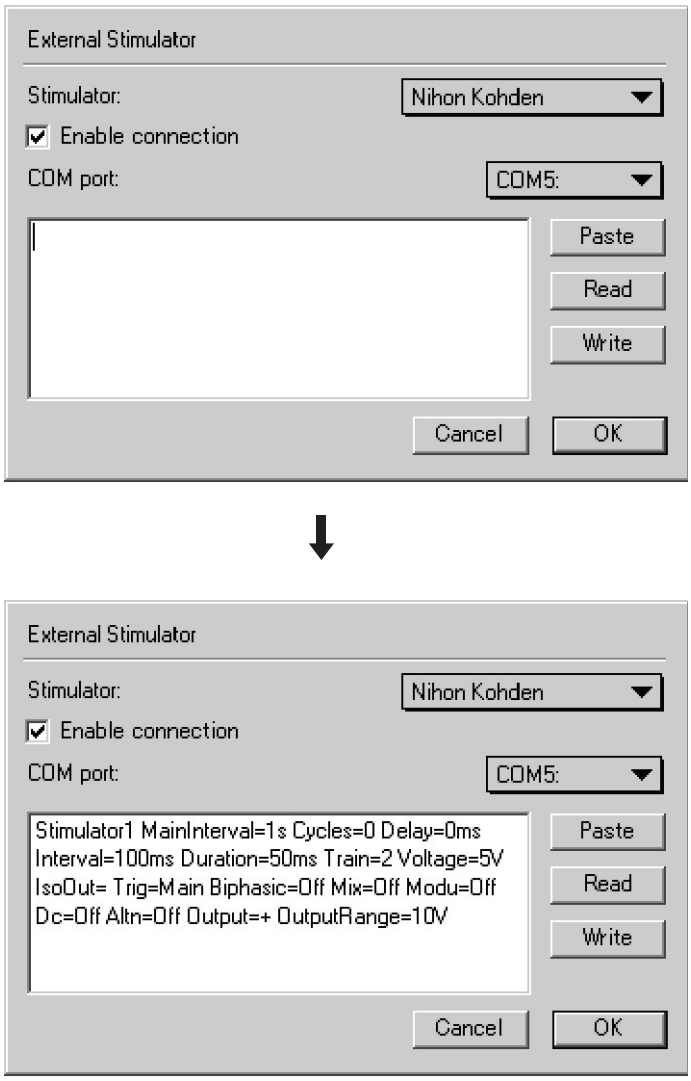
Click the Copy of the Edit menu to copy the selected condition.




3) Click the Preferences, and then click the External Stimulator in the Edit menu on the Scope Application. The External Stimulator window is opened.



4) Click the Paste button to the setting condition is put.




5) Confirm the setting condition is displayed, and then click the Write button.

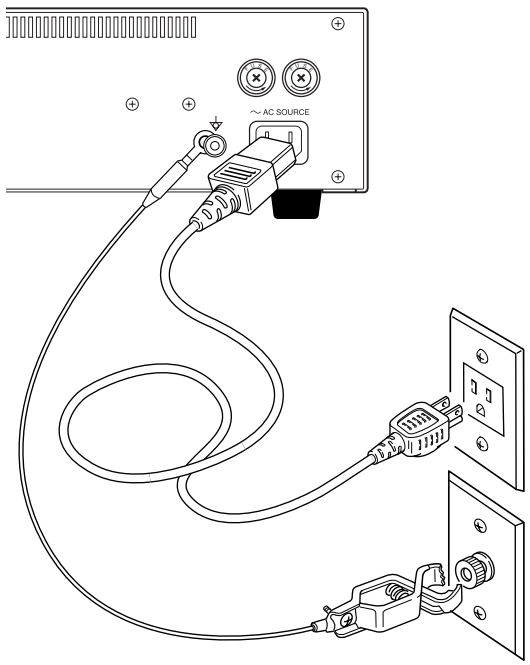
   The setting condition is set to the electronic stimulator.

## Installing the Stimulator

Take the following precautions when installing the stimulator.

1. Avoid contact with water or chemicals. Also, avoid direct contact with mist or humidified air from a humidifier as this may cause malfunction or reduce the service life of the stimulator.
2. Keep out of direct sunlight as this may result in an unexpected rise in temperature, causing malfunction or reducing the service life of the stimulator.
3. Make sure that the area is well ventilated. If the temperature inside the stimulator rises, it may cause malfunction or reduce the service life of the stimulator.
4. Do not place blankets or other objects on top of the stimulator.
5. Avoid placing in an area that is exposed to dust.
6. The power source must have sufficient capacity to supply the necessary power requirements of the stimulator. Reduced power resulting from insufficient capacity may affect the performance of the stimulator or activate the breaker, causing a power failure.
7. If any irregularity occurs when the power is turned on, turn the power off immediately and unplug the power cable from the power outlet. At the same time, mark the stimulator clearly as "Out of Order" and do not use it until it has been inspected and repaired.

## Connection of Cables




[Fig.29]

1. Ground wire
   Connect the supplied ground wire to the ground terminal and connect the other end to a reliable grounding conductor.
   - Avoid using water pipes as the grounding conductor as their grounding capability may not be reliable.
   - It is prohibited by law to use gas pipes as a grounding conductor.
2. Power cable
   Insert the supplied power cable with 3-pin plug into the power socket and insert the other end into an AC wall outlet.

> ⚠ CAUTION
>
> Always use the supplied 3-pin cable for the power cable.
> If any other power cable is used, it may result in an electric shock to the operator.

[Note] When the power cable with 3-pin plug is grounded in a 3-pin outlet with grounding electrode, the stimulator is automatically grounded. However, to prevent the effects of a broken ground wire inside the power cable, double grounding is recommended using the supplied ground wire.

3. When stimulating with the isolator, connect the isolator to the [to ISO] output connector.

[Note] • When connecting the isolator, tighten the screw firmly to prevent the cable from coming loose.
• When connecting the stimulation output cable, connect the cable securely to prevent it from coming loose.

4. If necessary, connect an oscilloscope and recorder and data acquisition/ analysis system, etc. as peripheral devices to measure and record phenomena after stimulation.

# Specifications

## Stimulation Trigger

Main Interval

(1) START
- A) MANUAL switch (front panel)
- B) START INPUT (rear)
  - Input pulse: +3.5 V or over, 10 μs or over
  - Input impedance: 10 kilohms or over
- C) Short-circuit of KEY terminal (rear) and E terminal

2) STOP
- A) MANUAL switch (front panel)
- B) STOP INPUT (rear)
  - Input pulse: +3.5 V or over, 10 μs or over
  - Input impedance: 10 kilohms and over

3) SET CYCLES
- Setting range: 1 ms to 9990 s, within ±0.1%
- Unit: ms, s
- Number: 3 digits

4) CYCLES
- Repeat count: 1 to 999
- Continuous stimulation: when set to “run”

5) External trigger
- TRIG LEVEL: 0 to +10 V continuous variable
  - Approx. 3 V when turned fully counterclockwise
- Input impedance: 100 kilohms or over

## Stimulation Waveform Setup

1) DELAY
- Setting range: 0 to 99.9 s, ±1%, within ±2 μs
- Unit: μs, ms, s
- Number: 3 digits

2) INTERVAL
- Setting range: 100 μ to 999s, within ±0.1%
- Unit: μs, ms, s
- Number: 3 digits

3) DURATION
- Setting range: 10 μ to 99.9 s, ±1%, within ±2 μs
- Unit: μs, ms, s
- Number: 3 digits

4) TRAIN

Setting range: 1 to 999

Continuous operation when set to “run”

## Stimulation Output

1) Output polarity and OFF

Polarity switch: Positive/negative polarity

(No effect on MODULATION or MIXING polarity)

OFF: No output to ISOLATOR or OUTPUT

2) MODULATION

Amplitude: Depends on amplitude of external signal including polarity (Max. ±10 V)

Linearity: within ±7% at ±1 V to ±10 V

Input impedance: 100 kilohms or over

No modulation in relation to MIXING waveform

3) MIXING

Mixing method: Analog addition

Mixing voltage range: 0 to ±10 V

(Voltage after mixing: max. ±10 V)

Linearity: within ±7% at ±1 V to ±10 V

Input impedance: 100 kilohms or over

4) DC

Output voltage: Direct current 0 to ±10 V

Direct current 0 to ±50 V when ±50 V output is selected

5) Isolator output (to ISO)

| | | |
|---|---|---|
| Pin: | 1, 2 | +15 V |
| | 3 | –15 V |
| | 4 | Signal output |
| | 5 | Range data |
| | 6 | E |
| | 7 | Range data synchronizing clock |
| | 8 | Void |
| | 9 | Void |
| | 10 | Void |

The fourth signal is not output fivefold when ±50 V output is selected. (±10 V)

6) Output

Linearity: 0 to ±1 V, within ±50 mV

Within ±1 V to ±10 V ±5%

Output impedance: 100 kilohms or less (at RL ≥ 2 kilohms)

Output waveform: 3 μs or less both rising and falling

Excessive deviation: 5% or less

7) ±50 V output

Linearity: 0 to ±5 V, within ±100 mV
±5 V to ±50 V, within ±5%

Output impedance: 10 ohms or less

Output waveform: 7 μs or less both rising and falling
Excessive deviation: 10% or less

Maximum output current: 400 mA or over

## Synchronized Output Signal

1) Output signal name

MAIN INTERVAL
SET CYCLES END
EXT TRIG
DELAY
INTERVAL
TRAIN END

2) Output signal

Amplitude: +5 V
Pulse width: approx. 500 μs
Rising: 3 μs or less
Output impedance: 1 kilohm or less

## Language

English

## Power Source

Voltage: AC 110 V, 220 V or 240 V ±10 %
(Changed voltage range by the connector)

Frequency: 50/60 Hz

Power input: 70 VA

## Environment

Main operating environment: Laboratory

### Operating Environment

Temperature: 10 to 40°C
Humidity: 30 to 90%
Atmospheric pressure: 70 to 106 kPa

### Storage Environment

Temperature: –20 to 60°C
Humidity: 10 to 95%
Atmospheric pressure: 70 to 106 kPa

## Durability

6 years (based on self-certification of company data)

## Installation

Indoor installation type

## Safety Standards

Applicable safety standards: IEC 60601-1
IEC 60601-1-2 :2001
Type of protection against electrical shock: Class I
Degree of protection against electrical shock where attached:
B applied parts
Degree of protection against harmful ingress or liquids:
IPX0 (devices w/o special protection)
Mode of operation: Continuous operation
Voltage endurance: AC 1500 V, 1 minute
Leakage current: 100 μA or less for both earth leakage and enclosure leakage
Insulation resistance: 50 megohms or over (DC 500 V)
Mechanical strength of stimulator: Compliant with impact NS7231-5.7, vibration NS7231-5.8

## Dimensions and Weight

Dimensions: 430 (W) x 98 (H) x 300 (D) mm
Weight: Approx. 8.3 kg

## Electromagnetic Compatibility

IEC 60601-1-2 :2001
EMC level (CISPR11) Class B

## Guidance and manufacture's declaration - electromagnetic emissions

This Model 1001 is intended for use in the electromagnetic environment specified below.

The customer or the user of the 1001 should assure that it is used in such an environment.

| Emissions test | Compliance | Electromagnetic environment guidance |
|---|---|---|
| RF emissions<br>CISPR 11 | Group 1 | The 1001 uses RF energy only for its internal function.<br>Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment. |
| RF emissions<br>CISPR 11 | Class B | The 1001 is suitable for use in all establishments,<br>including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes. |
| Harmonic emissions<br>IEC 61000-3-3 | Complies | |
| Voltage fluctuations/<br>flicker emissions<br>IEC 61000-3-3 | Complies | |

## Guidance and manufacture's declaration - electromagnetic immunity

This Model 1001 is intended for use in the electromagnetic environment specified below.

The customer or the user of the 1001 should assure that it is used in such an environment.

| Immunity test | IEC 60601 test level | Compliance level | Electromagnetic environment -Guidance |
|---|---|---|---|
| Electrodatic discharge (ESD)<br>IEC 61000-4-2 | ±6 kV contact<br>±8 kV air | ±6 kV contact<br>±8 kV air | Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%. |
| Electrical fast transient/ burst<br>IEC 61000-4-4 | ±2 kV for power supply lines | ±2 kV for power supply lines | Mains power quality should be that of a typical commercial or hospital environment. |
| Surge<br>IEC 61000-4-5 | ±1 kV differential mode<br>±2 kV common mode | ±1 kV differential mode<br>±2 kV common mode | Mains power quality should be that of a typical commercial or hospital environment. |
| Voltage dips, short interruptions and voltage variations on power supply input lines<br>IEC 61000-4-11 | <5% *Ut* (>95% dip in *Ut*) for 0.5 cycle<br><br>40% *Ut* (60% dip in *Ut*) for 5 cycles<br><br>70% *Ut* (30% dip in *Ut*) for 25 cycles<br><br><5% *Ut* (>95% dip in *Ut*) for 5s | <5% *Ut* (>95% dip in *Ut*) for 0.5 cycle<br><br>40% *Ut* (60% dip in *Ut*) for 5 cycles<br><br>70% *Ut* (30% dip in *Ut*) for 25 cycles<br><br><5% *Ut* (>95% dip in *Ut*) for 5s | Mains power quality should be that of a typical commercial or hospital environment.<br>If the user of the 1001 requires continued operation during power mains interruptions, it is recommended that the 1001 be powered from an uninterruptible power supply or a battery. |
| Power frequency (50/60 Hz) magnetic field<br>IEC 61000-4-8 | 3 A/m | 3 A/m | Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment. |
| NOTE: Ut is the AC mains voltage prior to application of the test level. | | | |

## Guidance and manufacture's declaration - electromagnetic immunity

This Model 1001 is intended for use in the electromagnetic environment specified below.

The customer or the user of the 1001 should assure that it is used in such an environment.

| Immunity test | IEC 60601 test level | Compliance level | Electromagnetic environment - guidance |
|---|---|---|---|
| | | | Portable and mobile RF communications equipment should be used no closer to any part of the 1001, including cables, than the recommended separation distance caluculated from the epuation applicable to the frequency of the transmitter.<br>Recommended separation distance |
| Conducted RF<br>IEC 61000-4-6 | 3 Vrms<br>150 kHz to 80 MHz | 3 Vrms<br>150 kHz to 80 MHz | $d = 1.2\sqrt{P}$ |
| Radiated RF<br>IEC 61000-4-3 | 3 V/m<br>80 MHz to 2.5 GHz | 3 V/m<br>80 MHz to 2.5 GHz | $d = 1.2\sqrt{P}$ 80 MHz to 800 MHz<br>$d = 2.3\sqrt{P}$ 800 MHz to 2.5 GHz<br>where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufactuer and d is the recommended separation distance in meters (m).<br>Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey*1, should be less than the compliance level in each frequency range*2.<br>Interference may occur in the vicinity of equipment |

NOTE1: At 80 MHz and 800 MHz, the higher frequency range applies.

NOTE2: These quidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

*1 Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey shoule be considered. If the measured field strength in the location in which the 1001 is used exceeds the applicable RF compliance level above, the 1001 should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the 1001.

*2 Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

## Recommended separation distances between portable and mobile RF communications equipment and the 1001

This Model 1001 is intended for use in the electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the 1101 can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the 1001 as recommended below, according to the maximum output power of the communications.

| Rated maximum output power of transmitter (W) | Separation distance according to frequency of transmitter (m) | | |
|---|---|---|---|
| | 150 kHz to 80 MHz<br>$d = 1.2\sqrt{P}$ | 80 MHz to 800 MHz<br>$d = 1.2\sqrt{P}$ | 800 MHz to 2.5 GHz<br>$d = 2.3\sqrt{P}$ |
| 0.01 | 0.12 | 0.12 | 0.23 |
| 0.1 | 0.38 | 0.38 | 0.72 |
| 1 | 1.2 | 1.2 | 2.3 |
| 10 | 3.8 | 3.8 | 7.2 |
| 100 | 12 | 12 | 23 |

For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufactuer.

NOTE1 At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.
NOTE2 These gudelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

## System Composition for EMC test

This 1001 is tested to comply with IEC 60601-1-2 :2001 with the following composition. If any part which is not specified by our company is used, the EMC specifications might not be satisfied.

| Units | Cable length |
|---|---|
| 1001 Electronic stimulator | ——— |
| Output Code (12pc) | 2 m |
| USB Code | 2 m |

This document was, as far as possible, accurate at the time of release. However, changes may have been made to the software and hardware it describes since then. ADInstruments Pty Ltd. reserves the right to alter specification as required. Late-breaking information may be supplied separately.

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| | |
|---|---|
| ⚠ DANGER | This alerts the user to imminent death or serious injury arising from misuse of the stimulator. |
| ⚠ WARNING | This alerts the user to possible death or serious injury arising from misuse of the stimulator. |
| ⚠ CAUTION | This alerts the user to possible injury or damage to property arising from misuse of the stimulator. |

Notes are also provided in this manual to alert the user to specific instructions or recommendations.

## General

⚠ WARNING

This device is designed for experimental and research applications and must not be used for therapeutic purposes.

## Precautions regarding settings

⚠ CAUTION

Always use the supplied 3-pin cable for the power cable.
If any other power cable is used, it may result in an electric shock to the operator.

⚠ CAUTION

Do not touch the connector pins. Discharge electrostatic energy by touching a grounded metal part before connecting. The instrument may be damaged by electrostatic energy.

⚠ CAUTION

If this instrument is connected to other peripheral devices, be sure that they are connected in the manner specified by the manufacturer.
Only connect devices specified by the manufacturer.
Connection to non-specified devices may result in electric shock to the operator by current of leakage.

## Precautions regarding maintenance

⚠ CAUTION

When maintaining (cleaning, sterilizing, etc.) the stimulator, be sure to turn the power off and unplug the power cable from the power outlet first.
Failure to do so may result in an electric shock or malfunction.

⚠ CAUTION

The electronic stimulator has a high voltage output capacity of up to ±50 V.
Directly touching the output terminals or electrodes during stimulation or when the power cord is connected during inspection and the stimulator is operable may result in electric shock.

## GENERAL HANDLING PRECAUTIONS

This device is intended for use only by qualified medical personnel.
Use only our approved products with this device. Use of non-approved products or in a non-approved manner may affect the performance specifications of the device. This includes, but is not limited to, batteries, recording paper, pens, extension cables, electrode leads, input boxes and AC power.

**Please read these precautions thoroughly before attempting to operate the instrument.**

1. **To safely and effectively use the instrument, its operation must be fully understood.**

2. **When installing or storing the instrument, take the following precautions:**
   (1) Avoid moisture or contact with water, extreme atmospheric pressure, excessive humidity and temperatures, poorly ventilated areas, and saline or sulphuric air.
   (2) Place the instrument on an even, level floor. Avoid vibration and mechanical shock, even during transport.
   (3) Avoid placing in an area where chemicals are stored or where there is danger of gas leakage.
   (4) The power line source to be applied to the instrument must correspond in frequency and voltage to product specifications, and have sufficient current capacity.
   (5) Choose a room where a proper grounding facility is available.

3. **Before Operation**
   (1) Check that the instrument is in perfect operating order.
   (2) Check that the instrument is grounded properly.
   (3) Check that all cords are connected properly.
   (4) Pay extra attention when the instrument is combined with other instruments to avoid misdiagnosis or other problems.

4. **During Operation**
   (1) The instrument must receive continual, careful attention.
   (2) Turn power off or remove electrodes and/or transducers when necessary to assure the safety.

5. **To Shutdown After Use**
   (1) Turn power off with all controls returned to their original positions.
   (2) Remove the cords gently; do not use force to remove them.
   (3) Remove the power cord from the AC SOURCE socket to isolate the instrument from the AC supply mains.
   (4) Clean the instrument together with all accessories for their next use.

6. **The instrument must receive expert, professional attention for maintenance and repairs. When the instrument is not functioning properly, it should be clearly marked to avoid operation while it is out of order.**

7. **The instrument must not be altered or modified in any way.**

8. **Maintenance and Inspection:**
   (1) The instrument and parts must undergo regular maintenance inspection at least every 6 months.
   (2) If stored for extended periods without being used, make sure prior to operation that the instrument is in perfect operating condition.
   (3) Technical information such as parts list, descriptions, calibration instructions or other information is available for qualified user technical personnel upon request from your distributor.

**CAUTION**

**United States law restricts this device to sale by or on the order of a physician.**

## EMC RELATED CAUTION

**This equipment and/or system complies with the International Standard IEC 60601-2 for electromagnetic compatibility for medical electrical equipment and/or system. However, an electromagnetic environment that exceeds the limits or levels stipulated in IEC 60601-1-2, can cause harmful interference to the equipment and/or system or cause the equipment and/or system to fail to perform its intended function or degrade its intended performance. Therefore, during the operation of the equipment and/or system, if there is any undesired deviation from its intended operational performance, you must avoid, identify and resolve the adverse electromagnetic effect before continuing to use the equipment and/or system.**

**The following describes some common interference sources and remedial actions:**

1. **Strong electromagnetic interference from a nearby emitter source such as an authorized radio station or cellular phone:**
   **Install the equipment and/or system at another location. Keep the emitter source such as cellular phone away from the equipment and/or system, or turn off the cellular phone.**

2. **Radio-frequency interference from other equipment through the AC power supply of the equipment and/or system:**
   **Identify the cause of this interference and if possible remove this interference source. If this is not possible, use a different power supply.**

3. **Effect of direct or indirect electrostatic discharge:**
   **Make sure all users and patients in contact with the equipment and/or system are free from direct or indirect electrostatic energy before using it. A humid room can help lessen this problem.**

4. **Electromagnetic interference with any radio wave receiver such as radio or television:**
   **If the equipment and/or system interferes with any radio wave receiver, locate the equipment and/or system as far as possible from the radio wave receiver.**

5. **Interference of lightning:**
   **When lightning occurs near the location where the equipment and/or system is installed, it may induce an excessive voltage in the equipment and/or system. In such a case, use an uninterruptible power supply.**

6. **Use with other equipment:**
   **When the equipment and/or system is adjacent to or stacked with other equipment, the equipment and/or system may affect the other equipment. Before use, check that the equipment and/or system operates normally with the other equipment.**

7. **Use of unspecified accessory, transducer and/or cable:**
   **When an unspecified accessory, transducer and/or cable is connected to this equipment and/or system, it may cause increased electromagnetic emission or decreased electromagnetic immunity. The specified configuration of this equipment and/or system complies with the electromagnetic requirements with the specified configuration. Only use this equipment and/or system with the specified configuration.**

**Caution - continued**

8. **Use of unspecified configuration:**
   **When the equipment and/or system is used with the unspecified system configuration different than the configuration of EMC testing, it may cause increased electromagnetic emission or decreased electromagnetic immunity. Only use this equipment and/or system with the specified configuration.**

9. **Measurement with excessive sensitivity:**
   **The equipment and/or system is designed to measure bioelectrical signals with a specified sensitivity. If the equipment and/or system is used with excessive sensitivity, artifact may appear by electromagnetic interference and this may cause mis-diagnosis. When unexpected artifact appears, inspect the surrounding electromagnetic conditions and remove this artifact source.**

**If the above suggested remedial actions do not solve the problem, consult your distributor for additional suggestions.**

---

## NOTE about Waste Electrical and Electronic Equipment (WEEE) directive 2002/96/EEC

**For the member states of the European Union only:**
**The purpose of WEEE directive 2002/96/EEC is, as a first priority, the prevention of waste electrical and electronic equipment (WEEE), and in addition, the reuse, recycling and other forms of recovery of such waste so as to reduce the disposal of waste.**
**Contact your representative for disposal at the end of its working life.**

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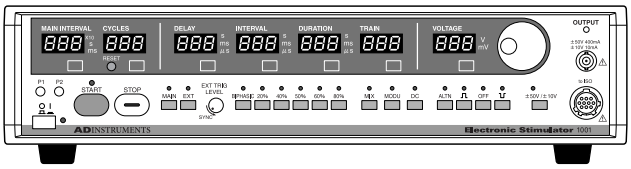
# Introduction

The electronic stimulator is used for the basic physiological and pharmacological research and experiments.

> ⚠ WARNING
>
> This device is designed for experimental and research applications and must not be used for therapeutic purposes.

By simple operation of the panel, a single pulse, pair pulse, train pulse and repeat pulse according to main interval can be output, as well as various mixed waveforms in combination with an external signal, and a biphasic pulse.

The stimulator is also equipped with a booster amplifier to allow field stimulation.




## Features

- Simple train stimulation

  A single pulse, pair pulse or train pulse can easily be output.
- Built-in main interval function, independent of stimulation waveform setup

  Starting/Stopping and the repeat time and repeat count can be set separately using the main interval function, ensuring simple, reliable operation.
- Field stimulation

  The built-in booster amplifier with a maximum output of ±50 V and 400 mA enables direct field stimulation with any stimulation waveform.
- Simple biphasic pulse stimulation
- Mixing and modulation input terminals that allow output of mixed and modulated waves through combination with an external signal
- Alternate stimulation by the addition of an evoked response to eliminate stimulation artifacts
- Output of information to an external device such as a Power Lab

  All set stimulation conditions and operating information can be output from the USB port to an external device.
- High precision, high reliability design

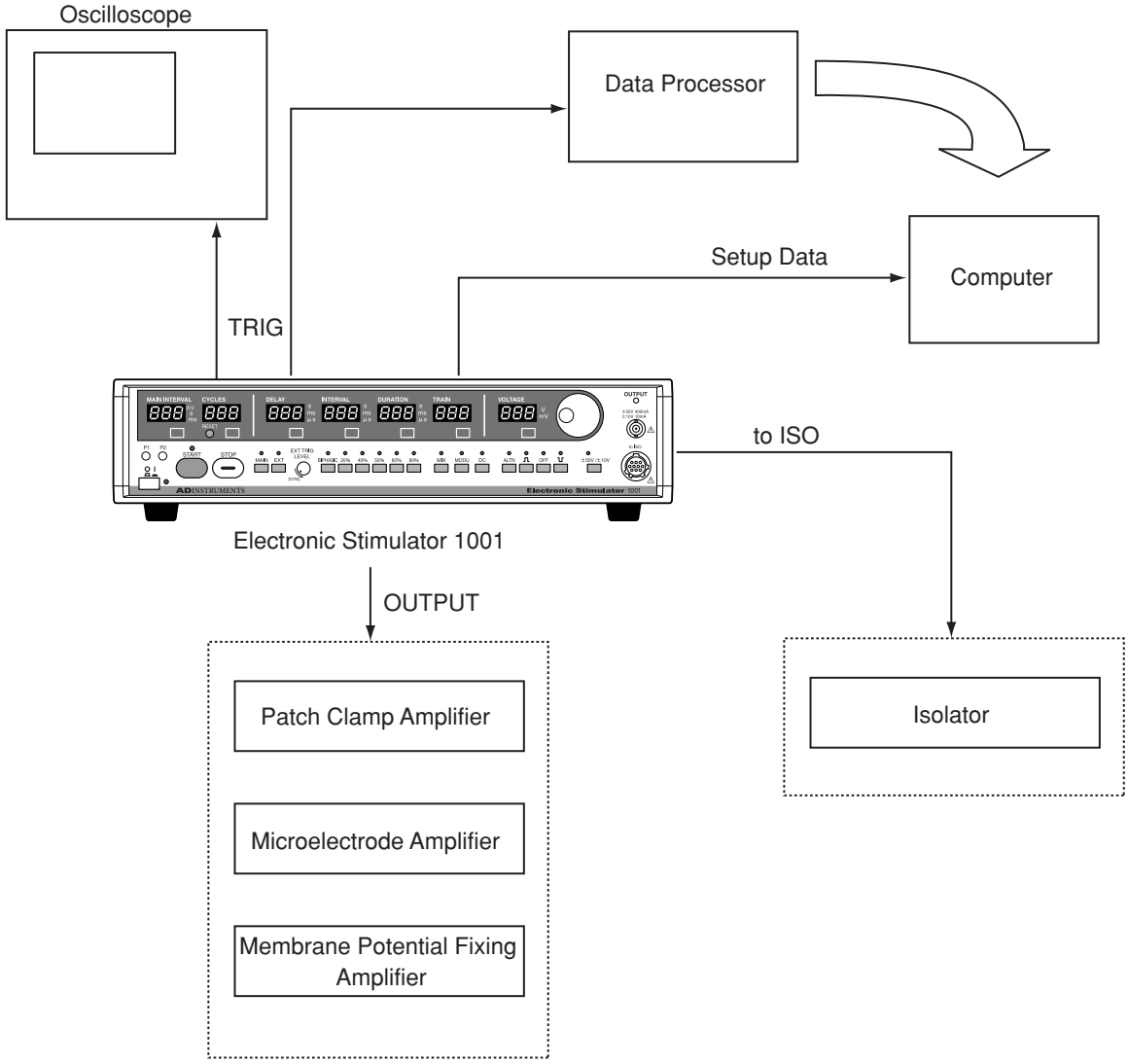
  By adopting a crystal oscillator as the internal base oscillation source and combined with IC technology, time-related items can be controlled with extreme precision, ensuring excellent reliability and reproducibility as well as stable operation.
- Fine adjustment of output voltage

  The output voltage setting can be adjusted up to 10 V.
- Input/Output protection circuit

  The built-in protection circuit prevents damage in the event of an accidental short circuit in the output terminal or synchronization signal output terminal or excessive voltage (max. 50 V) to the input terminal.

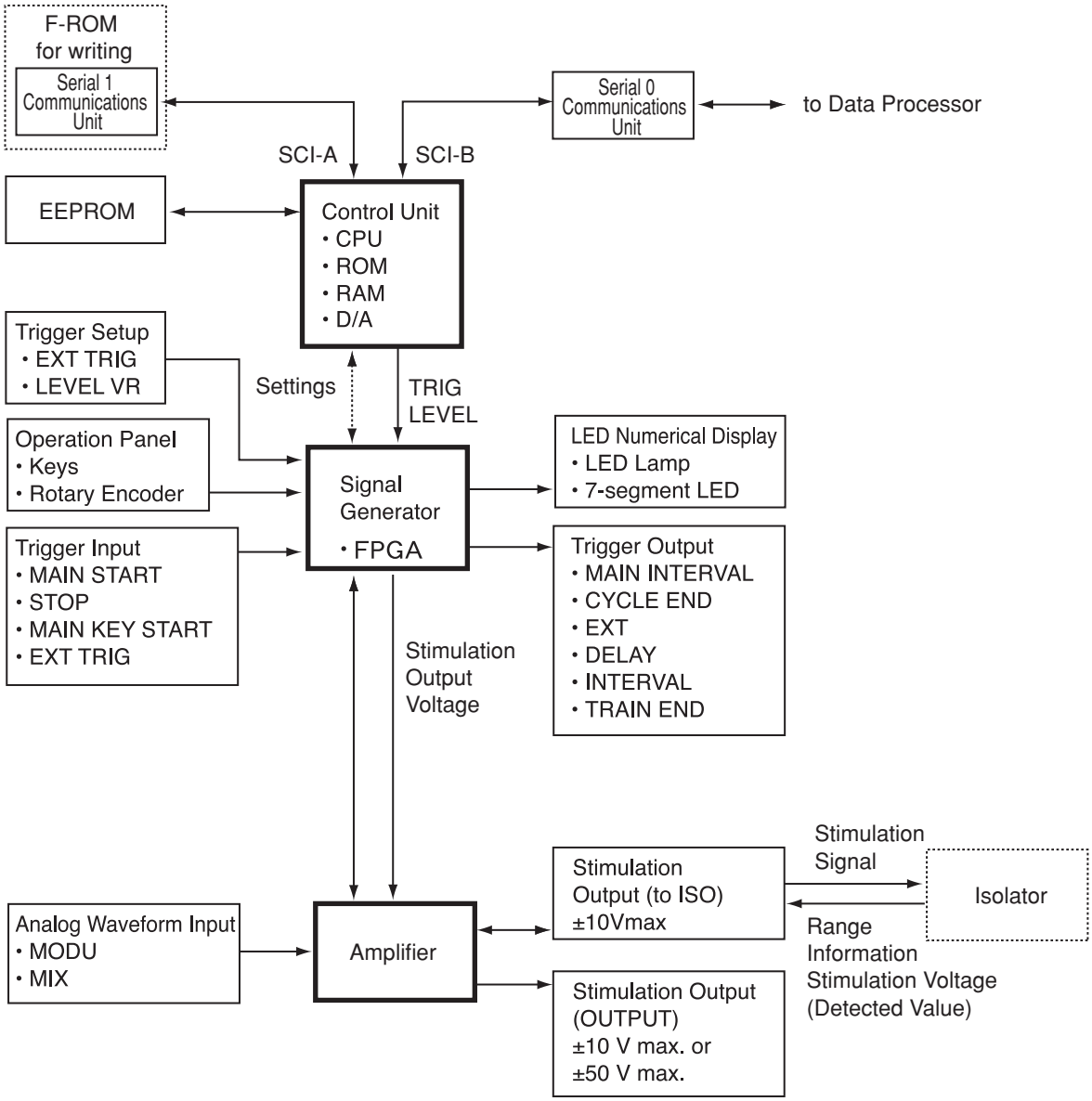
## Configuration

### Peripheral Devices




[Fig.1]

Electronic Stimulator 1001 Hardware Configuration




[Fig.2]

# Precautionary Labels and Indications

See the relevant reference page for details of each label or indication.

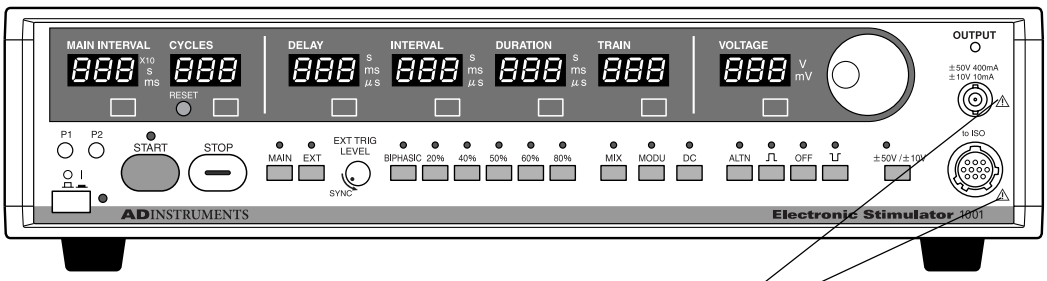
**⚠ CAUTION**

If this instrument is connected to other peripheral devices, be sure that they are connected in the manner specified by the manufacturer.
Only connect devices specified by the manufacturer.
Connection to non-specified devices may result in electric shock to the operator by current of leakage.

**⚠ CAUTION**

Do not touch the connector pins. Discharge electrostatic energy by touching a grounded metal part before connecting. The instrument may be damaged by electrostatic energy.

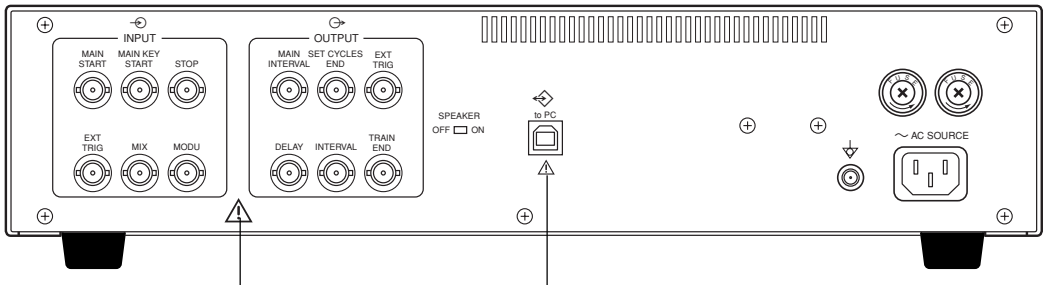
## Front




See P.1-14

[Fig.3]

## Rear




See P.1-20, 1-22

See P.1-23

[Fig.4]

# List of Symbols

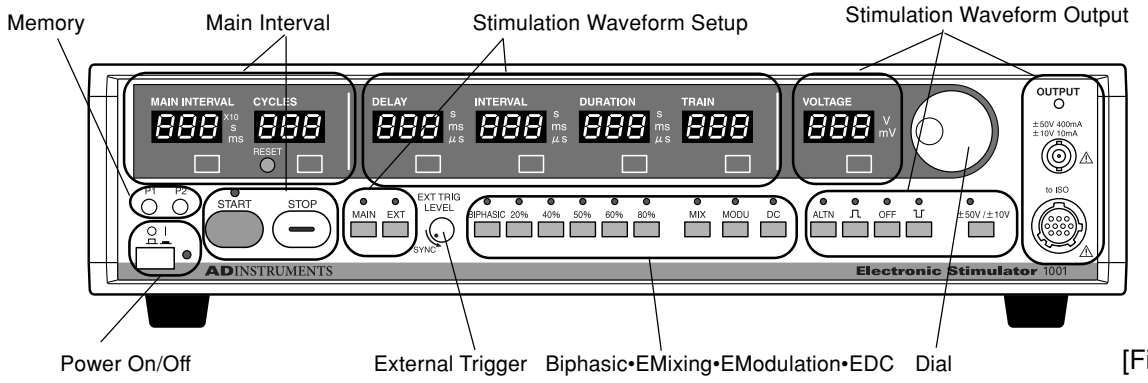
The following symbols are used in connection with the stimulator.
An explanation of each symbol is given in the table below.

* When the description of a symbol used for the stimulator differs from JIS standards, it is shown in brackets.

| Symbol | Description | Symbol | Description |
|---|---|---|---|
| | Caution / See attached materials | | [Serial I/O Terminal] |
|  | Power ON | | Input [Terminal] |
| | Power OFF | | Output [Terminal] |
|  | ON position [Power ON] | | Equipotential Ground [Terminal] |
| | OFF position [Power OFF] | | [Positive Polarity] |
| | Alternative Current (AC) | | [Negative Polarity] |
| | The products marked with this symbol apply to the European WEEE directive 2002/96/EEG and require separate waste collection. For the products labeled with this symbol, contact your representative for disposal at the end of its working life. | | |

# Description of Parts

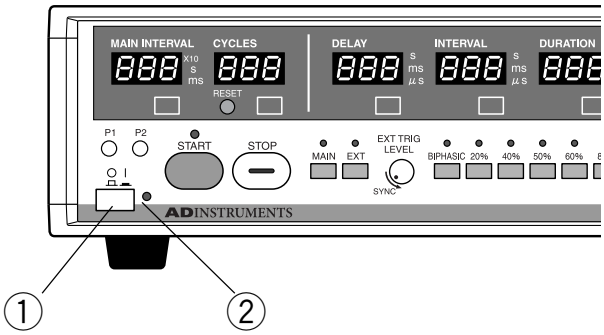
## Front




[Fig.5]

### Power On/Off

This button is used to turn the power on and off.

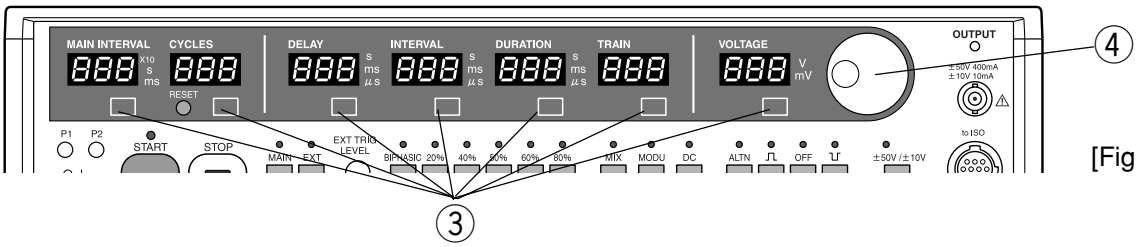



[Fig.6]

| Name | Function |
|---|---|
| ① Power Button<br>② Power Indicator Lamp | When the power button is pressed (ON position), the power indicator lamp lights and the power is turned on. To turn the power off, press the button again. When the power is turned on, all the LEDs light once (self-check). |

### Keys and Dial

Used to increase or decrease the set values. (See P.2 for details.)

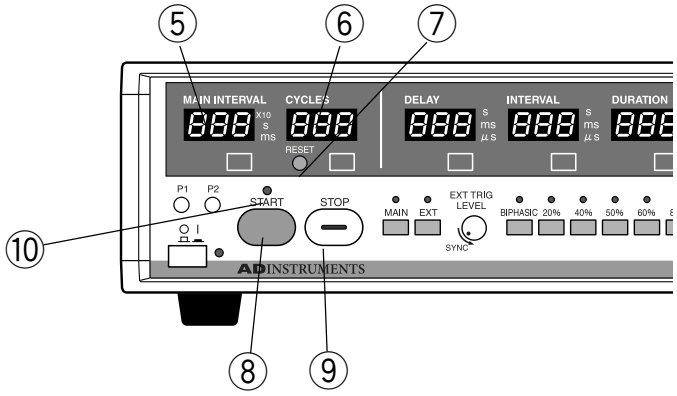



[Fig.7]

| Name | Function |
|---|---|
| ③ Keys | Press to adjust the set values. The indicator for the selected key blinks. The set value changes each time the key is pressed. |
| ④ Dial | Adjusts the set value selected with the selector key. Turn clockwise to increase the value and counterclockwise to decrease the value.<br>When the dial is pressed, the last selected set value blinks and is set. |

## Main Interval

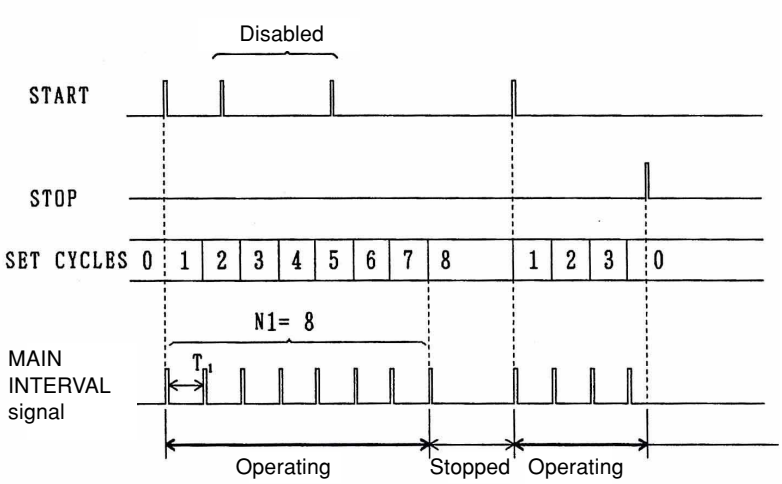
Controls the repeat cycle (T1) and repeat count (N1) as well as starting and stopping of stimulation.
(The timing signal created here acts becomes the trigger as MAIN INTERVAL and is not a direct stimulation waveform.)




[Fig.8]

| Name | Function |
|---|---|
| ⑤ Stimulation interval (T1) indicator (MAIN INTERVAL) | Displays the repeat interval (T1) setting.<br>Setting range: 1 ms to 9990 s |
| ⑥ Stimulation count indicator (CYCLES) | Displays the repeat count (N1) setting.<br>• CYCLES switches from displaying the repeat count (CYCLES) to displaying the repeat setting (SET CYCLES). (Normally CYCLES is displayed and the indicator is lit.)<br>• When the selector key is pressed, the display changes to SET CYCLES and the indicator blinks. (It automatically returns to CYCLES after about 10 seconds.)<br>• SET CYCLES can be changed by turning the dial while the indicator is blinking.<br>• While CYCLES is displayed, it is synchronized with stimulation output and shows the stimulation count.<br>Setting range: 1 to 999 or to continuous operation (run).<br>When the START signal is received, the set number of pulses is output by MAIN INTERVAL at the set interval (T1) and operation stops.<br>When continuous operation is set (run), after the START signal is received, the MAIN INTERVAL signal continues to be sent at the set interval (T1).<br>Operation continues until the STOP key is pressed. |
| ⑦ Stimulation count cancel key (RESET) | Resets the stimulation repeat count. |
| ⑧ Stimulation start key (START <MANUAL>) | Used to start stimulation manually.<br>When this key is pressed, MAIN INTERVAL operation Starts.<br>The START key is disabled during MAIN INTERVAL operation. (No restart.) |
| ⑨ Stimulation stop key (STOP <MANUAL>) | Used to stop stimulation manually.<br>When this key is pressed, MAIN INTERVAL and all other operation stops and the stimulator returns to initial status. |

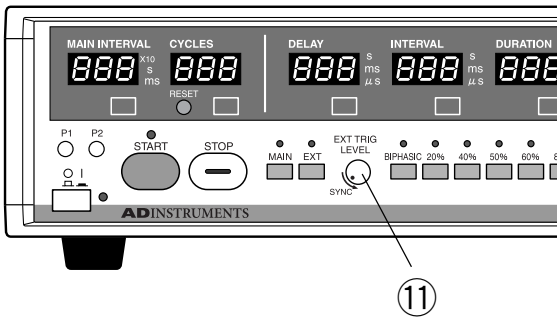
| Name | Function |
|---|---|
| ⑩ MAIN INTERVAL operation lamp | Lights when MAIN INTERVAL is operating.<br>(As it is sometimes difficult to tell whether MAIN INTERVAL is operating when a long interval has been set, operation can be judged by checking the lamp.) |




[Fig.9] MAIN INTERVAL operation when SET CYCLES is set to 008

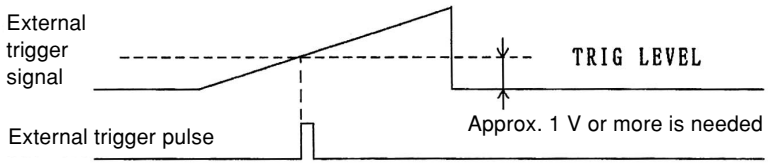
External Trigger (EXT TRIG)

Like MAIN INTERVAL, this generates a trigger pulse. It is used to control the stimulation repeat cycle by an external signal.
When EXT is selected with the trigger selector button, stimulation occurs in synchronization with the signal that is input to the external trigger terminal on the rear of the stimulator.




[Fig.10]

| Name | Function |
|---|---|
| ⑪ Trigger level adjustment knob (EXT TRIG LEVEL) | Selects whether the trigger is activated at the signal level that is input to the external trigger terminal (on rear).<br>Adjustment range: 0 to ±10 V.<br><br>If the sweep-wave output from the oscilloscope is used as the external trigger signal, the stimulation pulse can be monitored at any position on the oscilloscope tube by setting the level adjustment knob.<br>Allowing for a noise margin and hysteresis in the built-in comparator, use a trigger signal to oscillate up to about 1 V lower than the trigger level. |




[Fig.11]

When set to SYNC

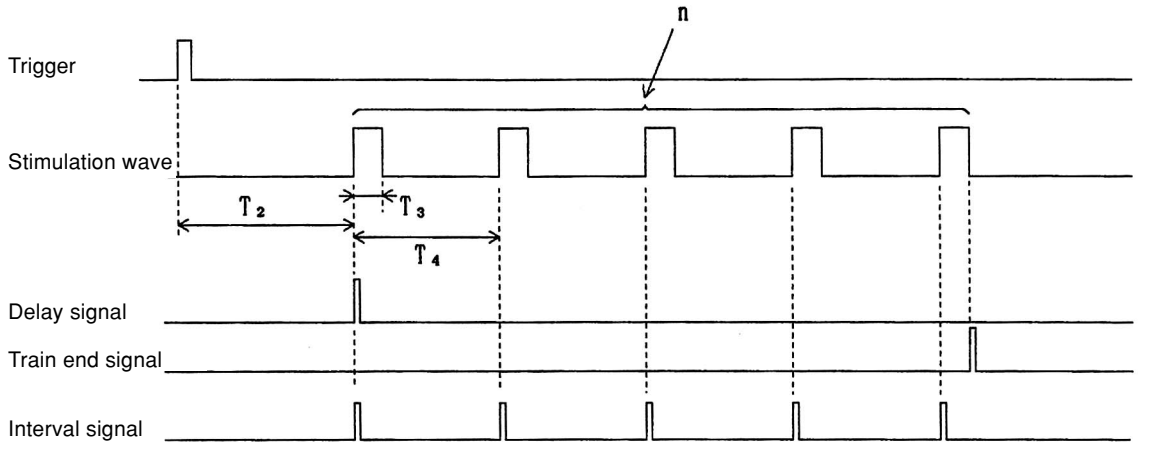
When the knob is turned fully counterclockwise until it locks (SYNC position), the trigger level is approximately +3 V.

When activating the trigger at a pulse of +5 V, the inconvenience of setting the level can by avoided by using this position.

## Stimulation Waveform Setup

This component receives the main interval trigger signal, external trigger signal, etc., sets the stimulation wave and timing and sends the signal for stimulation output.

The stimulation wave is determined by the four parameters in the figure below.



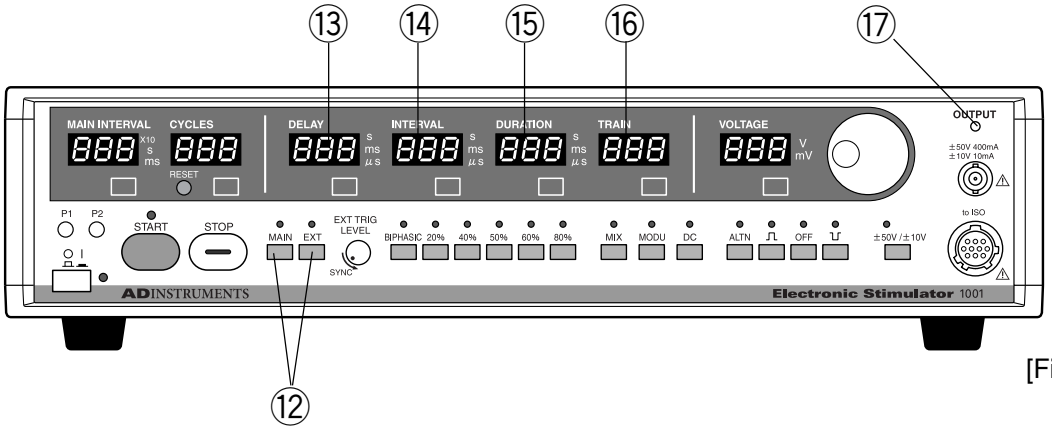

[Fig.12]

T2 = DELAY: delay time from trigger to start of stimulation

T3 = DURATION: duration of stimulation pulse

T4= INTERVAL: interval between stimulation pulses

n = TRAIN: number of stimulation pulses




[Fig.13]

| Name | Function |
|---|---|
| ⑫ Trigger signal selector key (MAIN, EXT) | Selects a trigger signal. The lamp for the selected key lights.<br>MAIN: Signal generated by MAIN INTERVAL described above<br>EXT: Signal generated by EXTERNAL TRIGGER described above |
| ⑬ Delay time display (DELAY) | Sets the delay time (T2) until the channel outputs a stimulation pulse after the trigger signal is received. The timing is shown in Fig.12. |

| Number | Setting range | Unit |
|---|---|---|
| 3 digits | 0-99.9 sec | s, ms, μs |

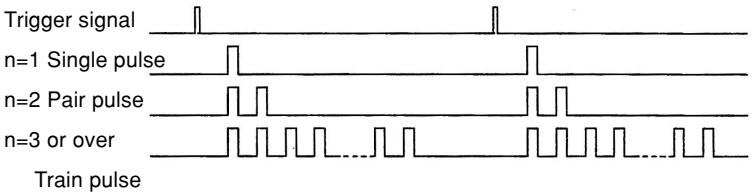
| | |
|---|---|
| ⑭ Stimulation pulse interval display (INTERVAL) | Sets the pulse interval (T4) when the number of stimulation pulses is set by TRAIN to 2 pulses or more or to continuous stimulation (run). The timing is shown in Fig.12. |

| Number | Setting range | Unit |
|---|---|---|
| 3 digits | 100 μsec to 999 sec | s, ms, μs |

| | |
|---|---|
| ⑮ Stimulation pulse duration display (DURATION) | Sets the stimulation pulse duration (T3). The timing is shown in Fig.12. |

| Number | Setting range | Unit |
|---|---|---|
| 3 digits | 10 μsec to 99.9 sec | s, ms, μs |

| | |
|---|---|
| ⑯ Stimulation pulse count display (TRAIN) | Sets the number (n) of stimulation pulses.<br>Fig.12 shows an example when n=5.<br>Setting range: 0 to 999.<br>Single pulse stimulation occurs at n=001, pair pulse stimulation at n=002 and train pulse stimulation at n=003 or over. |



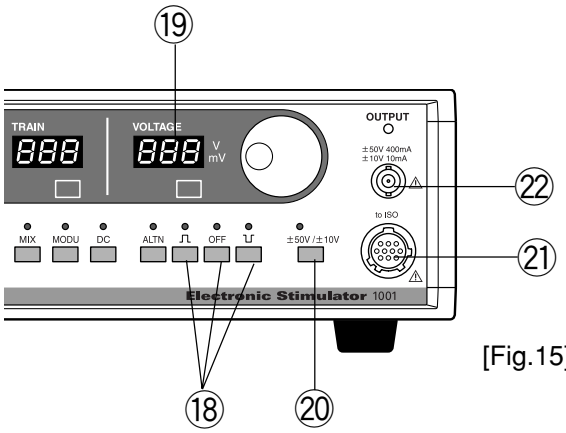

[Fig.14]

When run (set value: 000) is set, continuous stimulation occurs. After the trigger is initiated and the delay time has elapsed, pulse output continues at the set interval (T4).
Continuous stimulation continues until the STOP button is pressed.
The following trigger signals are disabled during stimulation.

| | |
|---|---|
| ⑰ Monitor lamp (OUTPUT) | Stimulation pulse monitor lamp.<br>It lights for at least 50 ms in synchronization with the stimulation pulse.<br>If the duration of the stimulation pulse is 50 ms or more, the lamp stays lit for the duration of the pulse.<br>As the purpose of the lamp is to monitor the timing of the stimulation pulse, it operates regardless of the polarity selector key, VOLTAGE setting or MIX key. |

## Stimulation Waveform Output

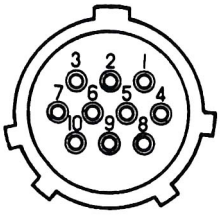
This sets the polarity of the waveform generated by stimulation waveform setup and the output voltage.




[Fig.15]

| Name | Function |
|---|---|
| ⑱ Polarity selector key (⎍, OFF, ⎏) | Switches the polarity of the stimulation pulse. ⎍ indicates positive polarity and ⎏ negative polarity.<br>The selection governs both the isolator connector and the output terminals. Output is 0 V when OFF is selected. |
| ⑲ Output voltage display (VOLTAGE) | Sets the output voltage of the stimulation waveform. Setting is performed by the same method as for other settings.<br>Normally, setting is 0 mV or from 10 mV to 10 V. If ±50 V is selected, setting is 0 mV or from 10 mV to 50 V. (1 mV to 9 mV cannot be set.)<br>This setting does not affect the mixing signal or modulation signal. DC voltage in DC mode is also set.<br>When negative polarity (⎏) is selected with the polarity selector key, it is read as it is as minus voltage. Output precision in relation to the command is within ±5% ±50 mV. |

| Name | Function |
|---|---|
| ⑳ Output selector key (±50 V / ±10 V) | When the key is pressed, the lamp lights and 5 times the normal voltage of 0 to ±10 V is supplied to the output terminal.<br>This can be used for field stimulation.<br>(max. 0 to ±50 V, 400 mA)<br>Additionally, key operation does not affect output to the isolator (to ISO connector). |
| ㉑ to ISO (Isolator output connector) | Drives the isolator when connected to the connector. |



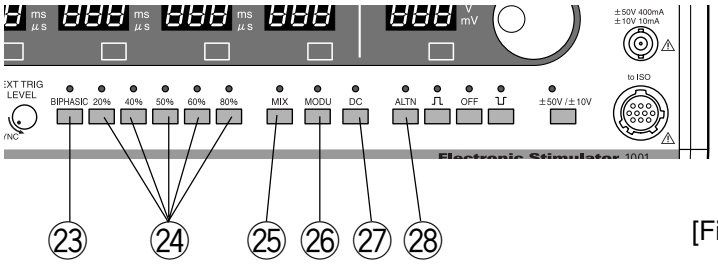

[Fig.16]

| Pin No. | Signal |
|---|---|
| 1, 2 | +15V |
| 3 | –15V |
| 4 | SIGNAL OUT |
| 5 | Range data |
| 6 | E |
| 7 | Range data synchronizing clock |
| 8, 9, 10 | Void |

| | |
|---|---|
| ㉒ Output terminal | As the output waveform is the same as that of the isolator output connector, this is useful for monitoring the stimulation waveform.<br>It can also be used for the stimulation signal to the microelectrode amplifier or membrane potential fixing amplifier .<br>However, when output is switched to ±50 V, the waveform is not the same as the isolator output connector signal, and five times the voltage is generated. Use this terminal directly for field stimulation.<br>[Note] Take care to avoid short-circuiting during stimulation, otherwise no stimulation will occur. |

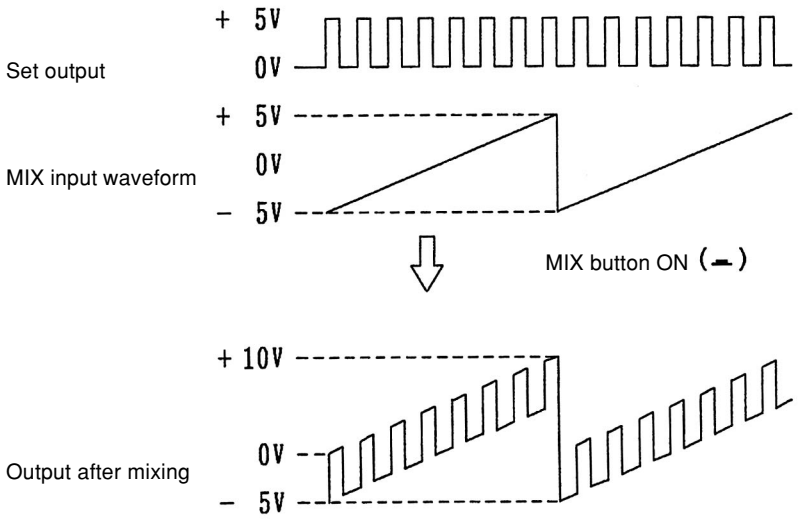
## BIPHASIC, MIX, MODU, DC, ALTN

These keys are used when stimulation is performed by biphasic wave, a composite wave created by mixing with an external waveform, a waveform where the external signal has been modulated by internal oscillation, or with DC voltage.



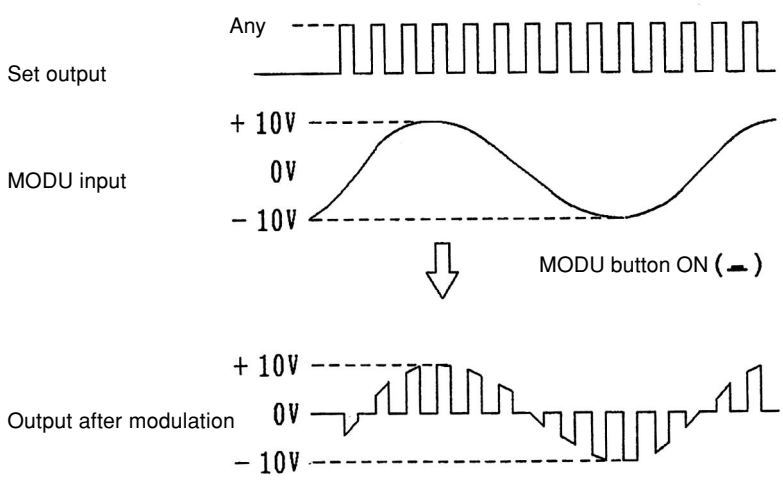

[Fig.17]

| Name | Function |
|---|---|
| ㉓ Biphasic waveform key (BIPHASIC) | Press to output a biphasic waveform. (The lamp lights.) |
| ㉔ Biphasic negative polarity voltage selector key (20%, 40%, 50%, 60%, 80%) | Selects a time percentage in relation to the value set by DURATION of the positive-polarity pulse in biphasic waveform. The set value becomes the time percentage of the positive-polarity pulse and the remaining time becomes the negative-polarity pulse.<br>The lamp for the selected key lights. |
| ㉕ Waveform mixing key (MIX) | When the MIX key is pressed, the set stimulation waveform can be combined with another waveform. (The lamp lights.)<br>Amplitude is added in units of 1. The waveform becomes distorted if the voltage after mixing exceeds a range of ±10 V. |




[Fig.18]

| Name | Function |
|---|---|
| ㉖ Waveform modulation key (MODU) | Press this key to modulate the external signal to the waveform created in stimulation waveform setup described above. (The lamp lights.) Connect the modulated signal to the MODU terminal on the rear of the stimulator. The VOLTAGE setting is disabled when this key is pressed. |



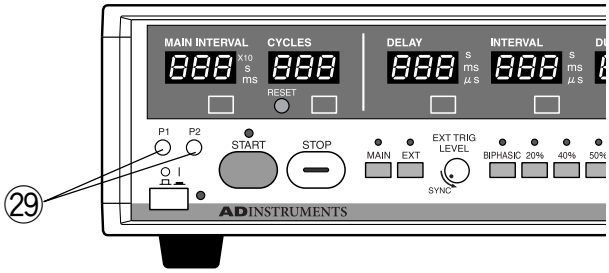

[Fig.19]

The range of the input voltage is within ±10 V. Output is modulated in the same amplitude as the input signal.

| | |
|---|---|
| ㉗ Direct current key (DC) | Press this key to create DC stimulation. (The lamp lights.) When this key is pressed, a DC signal is output, regardless of the setting or action of the stimulation waveform setup described above. The output voltage is set by VOLTAGE. When the polarity selector key is set to ⎍, plus-voltage is generated, and when it is set to ⎎, minus- voltage is generated. There is no output when set to OFF. |
| ㉘ Alternate key (ALTN) | Stimulation waveforms can be output by alternate polarity.<br>Both the isolator connector and the output terminals are affected. The polarity is not switched in relation to the MIXING or MODULATION signal. |

## Memory

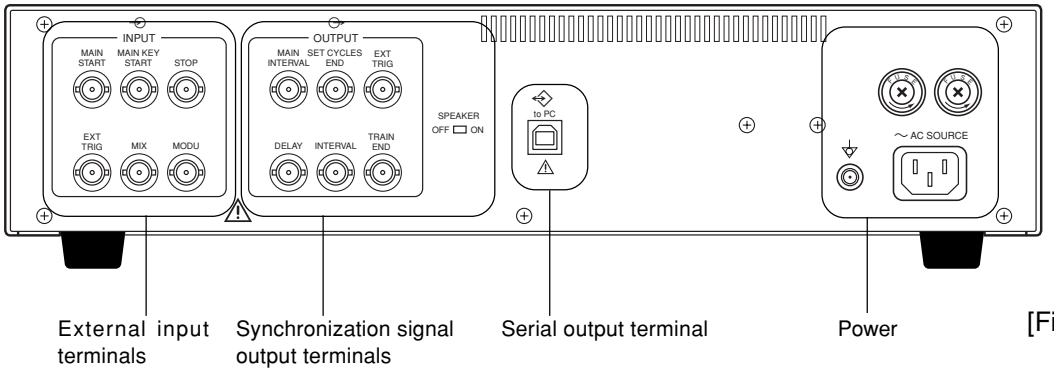
Settings can be saved for retrieval later.




[Fig.20]

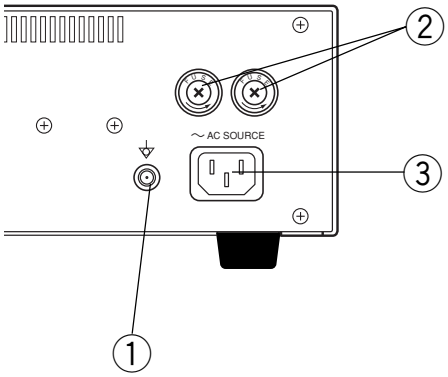
| Name | Function |
|---|---|
| ㉙ Memory keys (P1, P2) | To save the settings, press P1 or P2 for more than 2 seconds. The current settings are saved to the selected memory.<br>Pressing P1 or P2 briefly later will retrieve and apply the saved settings. |

## Rear




[Fig.21]

### Power

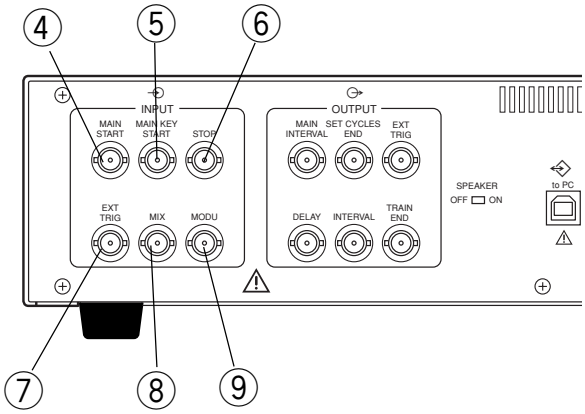



[Fig.22]

| Name | Function |
|---|---|
| ① Equipotential ground terminal | Connect the ground wires of accessory devices to ground the devices. |
| ② Fuse holder (FUSE) | Contains a time-lag fuse.<br>The fuse should only be changed by Nihon Kohden sales personnel or a qualified electrician.<br>To change the fuse, turn the "+" groove in the holder with a screwdriver, remove the fuse and insert the supplied new fuse. |
| ③ Power IN connector (AC SOURCE) | Connect the supplied power cable to supply AC power to the stimulator. |

## External Signal Input Terminals

[Note] Input the signals to the input terminals in the range specified in the input conditions. If the signal exceeds the range, it may cause failure or malfunction.




[Fig.23]

| Name | Function |
|---|---|
| ④ Main start signal input terminal (MAIN START) | Input the signal to this terminal to commence main interval operation by an external signal. It has the same function as the START button on the front panel. The input signal must be a pulse waveform of +3.5 V or over with a width of 10 μ sec or over. |
| ⑤ Main key start terminal (MAIN KEY START) | When this terminal is short-circuited to the E (Earth) terminal, MAIN INTERVAL operation commences.<br>The function is the same as the START button on the front panel. |
| ⑥ Stop signal input terminal (STOP) | Input the signal to this terminal to stop stimulation by an external signal. The function is the same as the STOP button on the front panel. The input signal conditions are the same as for START. |
| ⑦ External trigger input terminal (EXT TRIG) | Input a signal to this terminal to trigger stimulation by an external signal.<br>Setting range: 0 to +10 V.<br>(See “External trigger level knob”)<br>• Input conditions<br>Input impedance: approx. 100 kilohms<br>Allowable range of input voltage: 0 to +50 V |

| Name | Function |
|---|---|
| ⑧ Mixing signal input terminal (MIX) | Input the desired signal to this terminal to combine it with an external signal when performing stimulation.<br>The mixed signal can be obtained by pressing the MIX key on the front panel after connecting the signal.<br>• Input conditions<br>Input impedance: approx. 100 kilohms<br>Effective input voltage range: ±10 V |
| ⑨ Modulation signal input terminal (MODU) | Input the signal to this terminal to modulate the external waveform by internal oscillation. When the waveform has been modulated by the internally created pulse, it can be output by pressing the MODU key on the front panel after connecting the signal.<br>• Input conditions<br>Input impedance: approx. 100 kilohms<br>Effective input voltage range: ±10 V |

## Synchronizing Signal Output Terminal

The following signal is provided as a synchronizing signal for other devices.

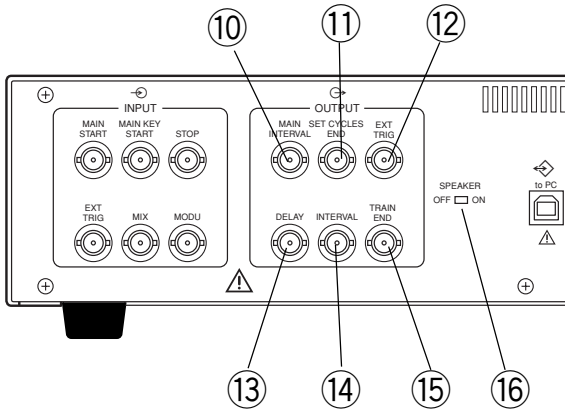
The synchronizing signal is output regardless of the MIX, MODU or DC polarity selector keys or the VOLTAGE setting.

For example, even when the DC key is pressed and no pulse is output, the END and DELAY pulses are output according to stimulation waveform setup.

Output impedance: approx. 1 kilohm

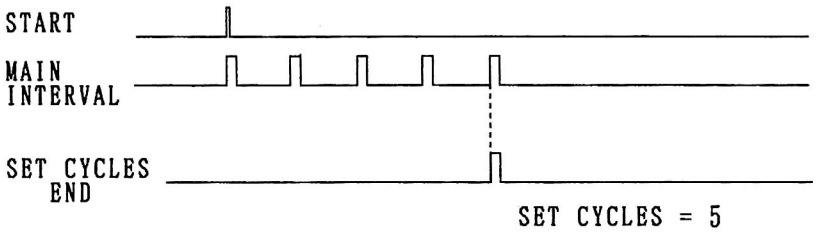
Amplitude: approx. +5 V

Pulse duration: approx. 500 μs




[Fig.24]

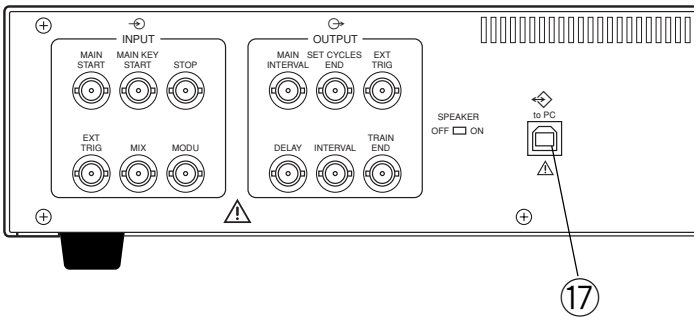
| Name | Function |
|---|---|
| Main interval output terminal (MAIN INTERVAL) | Generates a pulse that is synchronized with the MAIN INTERVAL trigger signal. |
| Set cycle end signal output (SET CYCLES END) | Generates a pulse that is synchronized with the last MAIN INTERVAL repeat pulse. When CYCLES is set to 005 and MAIN INTERVAL is started, the pulse is output at the fifth main interval. |
| External trigger output terminal (EXT TRIG) | Generates a pulse that is synchronized with the trigger signal created by the external trigger signal. |




[Fig.25]

| name | Function |
|---|---|
| Delay signal output terminal (DELAY) | Generates a pulse that is synchronized with the delay signal generated by stimulation waveform setup. (See Fig.12 for the timing.) |
| Interval signal output terminal (INTERVAL) | Generates a pulse that is synchronized with the interval. (See Fig.12 for the timing.) |
| Train end signal output terminal (TRAIN END) | Generates a pulse that is synchronized with the train end signal generated by stimulation waveform setup. (See Fig.12 for the timing.) |
| Synchronized sound on/off switch (SPEAKER ON/OFF) | Switches the synchronized sound on and off. |

## Serial Output




[Fig.26]

| Name | Function |
|---|---|
| Serial I/O terminal (to PC) | Various setup data can be sent to and from a computer. |

# General Handling Precautions

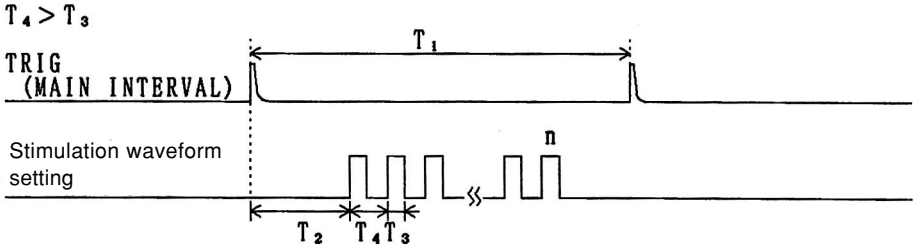
**⚠ CAUTION**

The electronic stimulator has a high voltage output capacity of up to ±50 V.
Directly touching the output terminals or electrodes during stimulation or when the power cable is connected during inspection and the stimulator is operable may result in electric shock.

1. The timing for each stimulation waveform setting is set automatically according to the following eqvation.

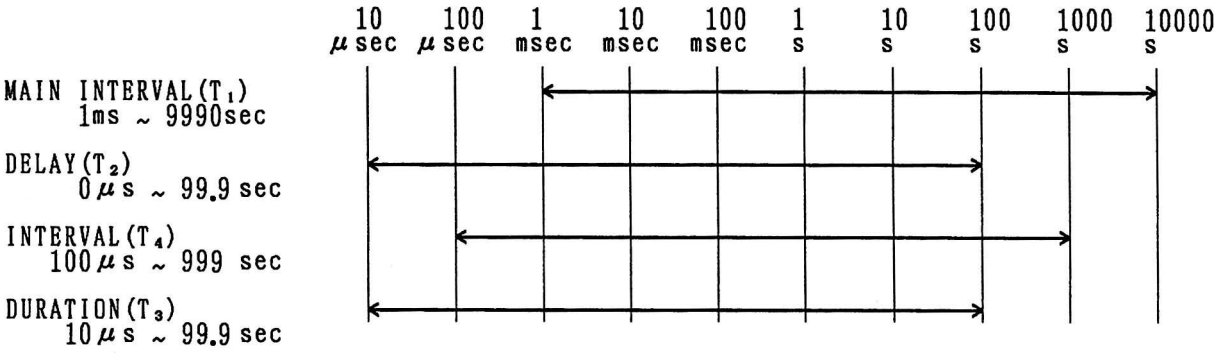
$T_1 > T_2 + T_4 \times (n-1) + T_3$

$T_4 > T_3$




[Fig.27]

Setting is performed in the order T1 > T2 > T4 > T3 > n.




[Fig.28]

2. Make sure that operation has stopped before pressing the keys. If the keys are pressed while the stimulator is operating, the new setting will be reflected in stimulator operation immediately. Care must therefore be taken as unexpected stimulation may result.

3. When all the number settings on the dial are set to 0, the following occurs.

CYCLE: Continuous stimulation (indicated as “run”)
DELAY: Delay time = 0
TRAIN: Continuous stimulation (indicated as “run”)

5. The output terminal has a short-circuit protective circuit, but avoid short-circuiting for long periods as this may adversely affect the performance of the stimulator.

6. When the power is turned on, output is momentarily unstable and a spike pulse may be generated. When stimulating, this spike may become the stimulation pulse. Turn the power on before attaching the electrodes.

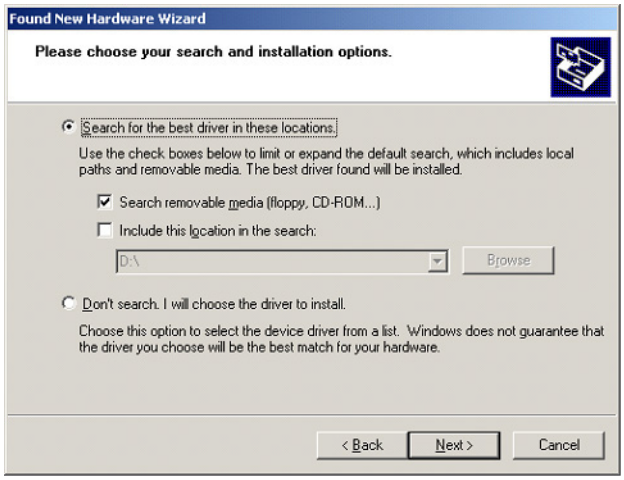
7. Do not use the stimulator with the cover on as this may cause overheating.

## Installing the Serial Converter Driver Software

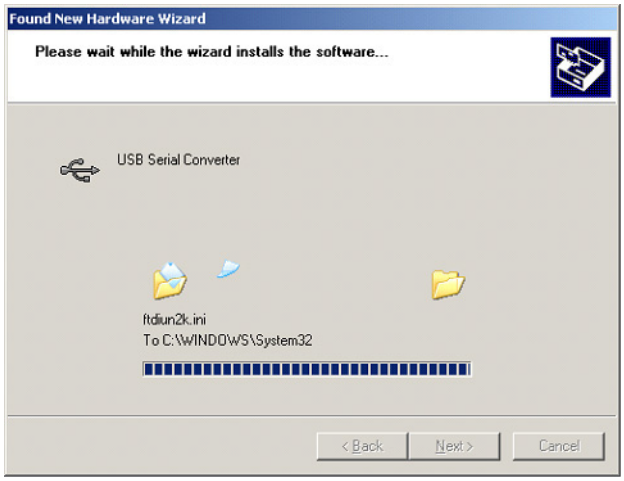
1. Turn on the PC is installed the Scope application.
   End the Scope application once while the Scope application is operating.
2. Set the CD-ROM of the driver software attached to the electronic stimulator to the CD drive of the PC.
3. Turn on the electronic stimulator.
4. Connect the electronic stimulator to the PC with the USB cable attached to the electronic stimulator.
   The New hardware detection wizard is opened.
5. Click “Install from a list or specific location (Advanced)”, and then click the Next > button.

Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
This wizard helps you install software for:
USB <-> Serial
If your hardware came with an installation CD or floppy disk, insert it now.
What do you want the wizard to do?
Install the software automatically (Recommended)
Install from a list or specific location (Advanced)
Click Next to continue.
< Back
Next >
Cancel

6. Click “Search for the best driver in these locations.”.
   Specify the CD-ROM drive, and then click the Next > button.

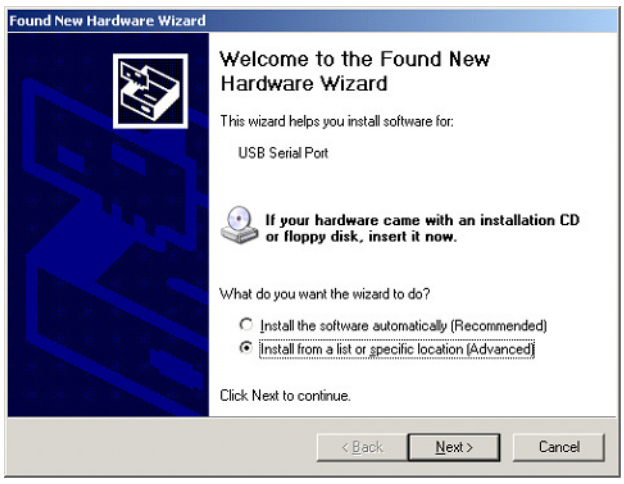

Found New Hardware Wizard
Please choose your search and installation options.
Search for the best driver in these locations.
Use the check boxes below to limit or expand the default search, which includes local paths and removable media. The best driver found will be installed.
Search removable media (floppy, CD-ROM...)
Include this location in the search:
D:\
Browse
Don't search. I will choose the driver to install.
Choose this option to select the device driver from a list. Windows does not guarantee that the driver you choose will be the best match for your hardware.
< Back
Next >
Cancel

7. Installing the USB Serial Converter driver software is started.

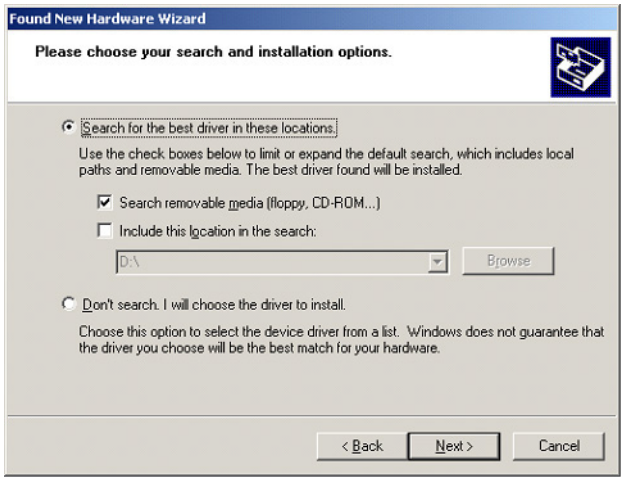



8. Click the Finish button to finish installing the USB Serial Converter driver software.
   The USB Serial Port driver software is continuously installed.

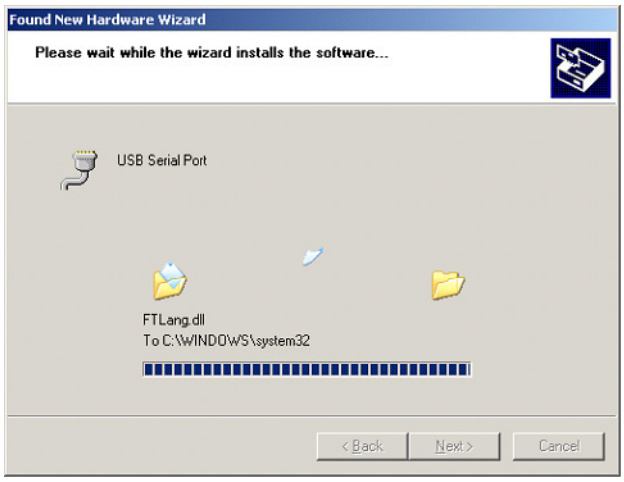
9. The following window is displayed when waiting for a while.
   Click “Install from a list or specific location (Advanced)”, and then click the Next > button.


Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
This wizard helps you install software for:
USB Serial Port
If your hardware came with an installation CD or floppy disk, insert it now.
What do you want the wizard to do?
Install the software automatically (Recommended)
Install from a list or specific location (Advanced)
Click Next to continue.
< Back
Next >
Cancel

10. Click “Search for the best driver in these locations.”.
    Specify the CD-ROM drive, and then click the Next > button.


Found New Hardware Wizard
Please choose your search and installation options.
Search for the best driver in these locations.
Use the check boxes below to limit or expand the default search, which includes local paths and removable media. The best driver found will be installed.
Search removable media (floppy, CD-ROM...)
Include this location in the search:
D:\
Browse
Don't search. I will choose the driver to install.
Choose this option to select the device driver from a list. Windows does not guarantee that the driver you choose will be the best match for your hardware.
< Back
Next >
Cancel

11. Installing the USB Serial Port driver software is started.

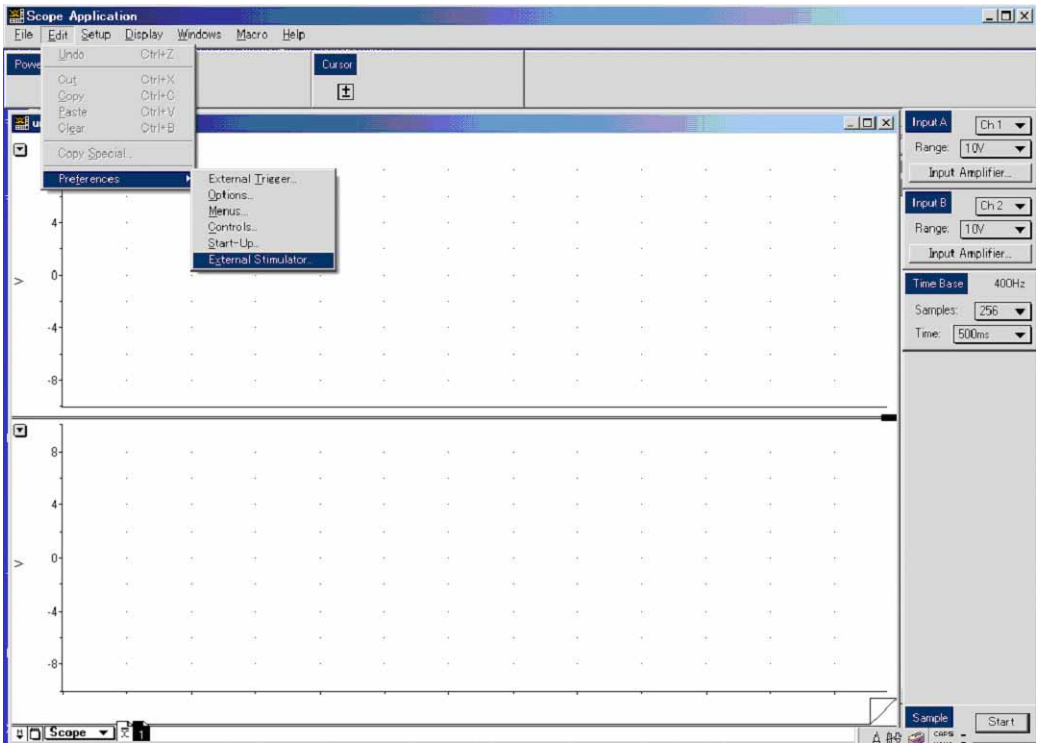



12. Click the Finish button to finish installing the USB Serial Port driver software.

## Scope Settings

1. Initial setting of the Scope (PowerLab)

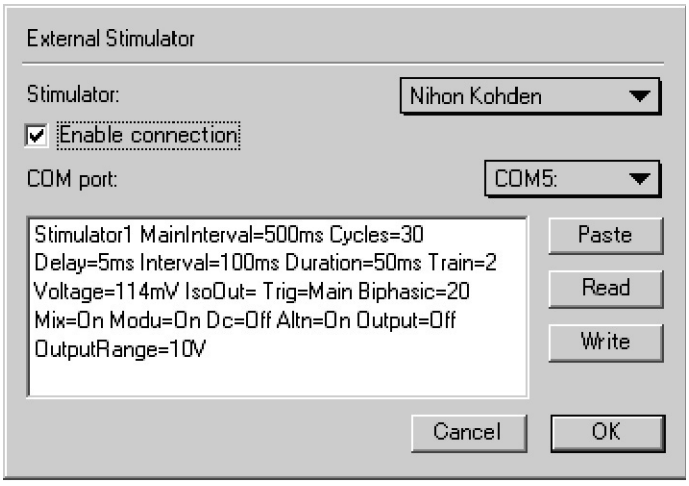
   1) Click the Preferences, and then click the External Stimulator in the Edit menu on the Scope Application. The External Stimulator window is opened.




   2) Select appropriate COM port, and check the Enable connection check box. The setting information of the electronic stimulator is displayed on the External Stimulator window.

### NOTE

When the setting information is not displayed, select COM port again after confirming the PC (installed Scope application) is connected with the electronic stimulator.

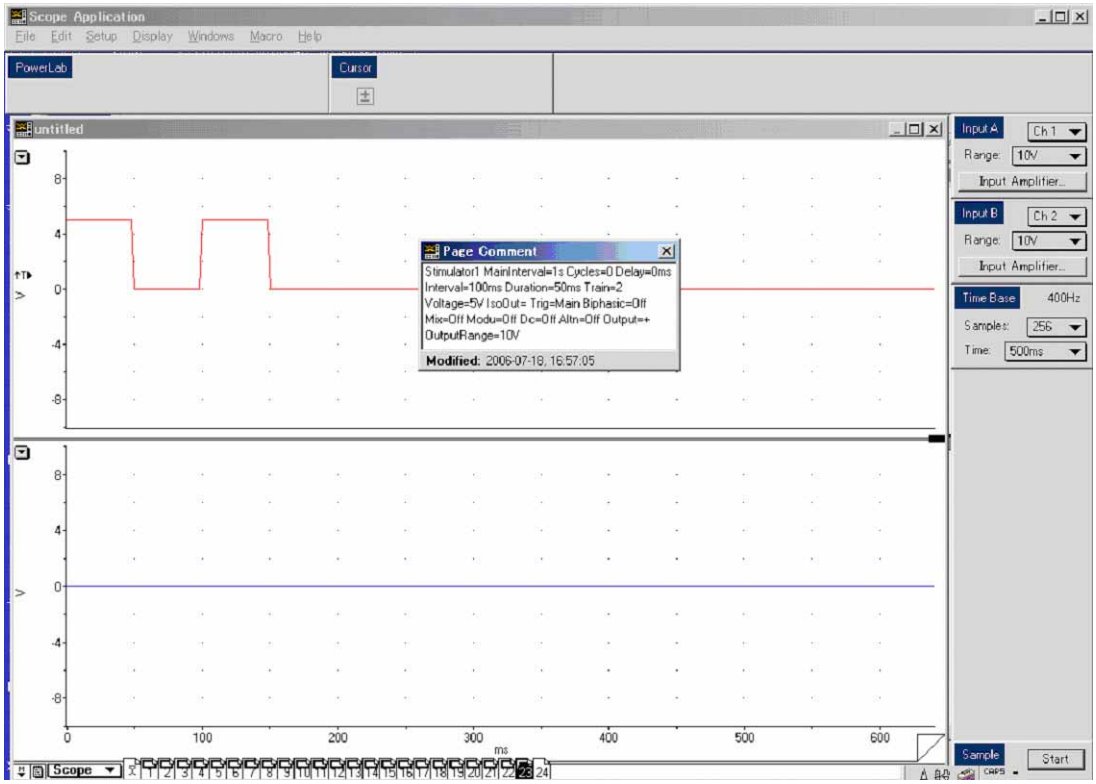


2. Taking of the setting information of the electronic stimulator into the Scope application

   The Scope begins at the same time when the START button of the electronic stimulator is pushed.

   The setting information of the electronic stimulator is taken automatically into the Page Comment window on the Scope application.

   Taken the setting information can be confirmed by opening the Page Comment window.



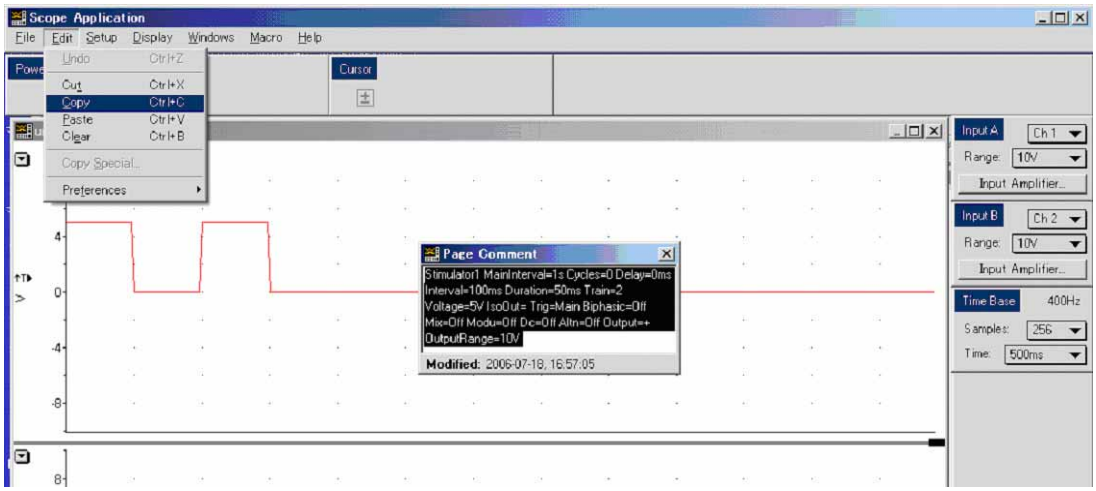
3. Setting the electronic stimulator from the Scope application

The stimulation condition of the electronic stimulator can be set by the screen operation by the Scope application.

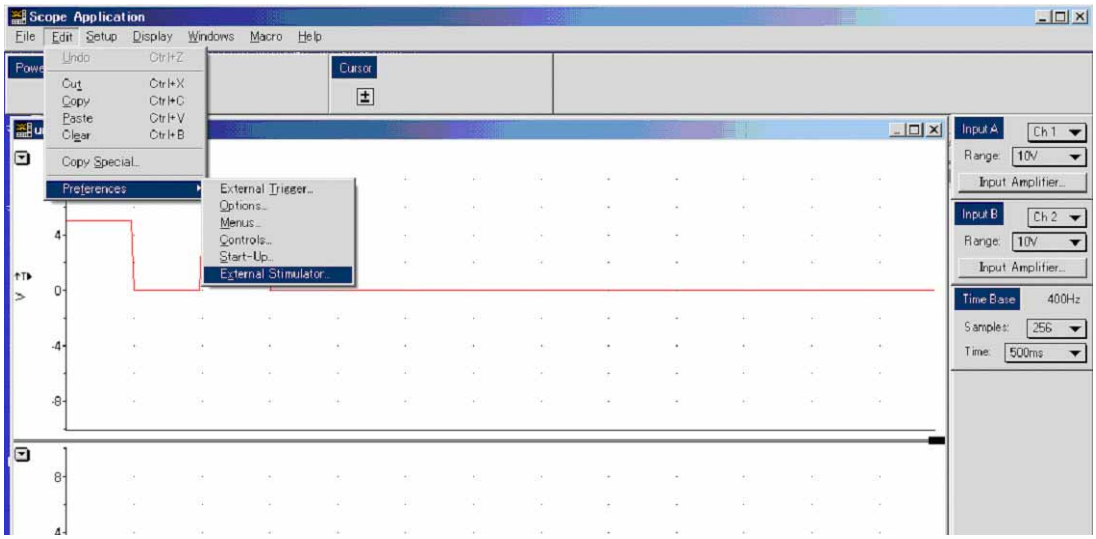
1) The Page Comment window is opened on an arbitrary screen of the Scope application, and the content is confirmed as shown in the figure below.

2) Select the displayed conditions by the drug operation.

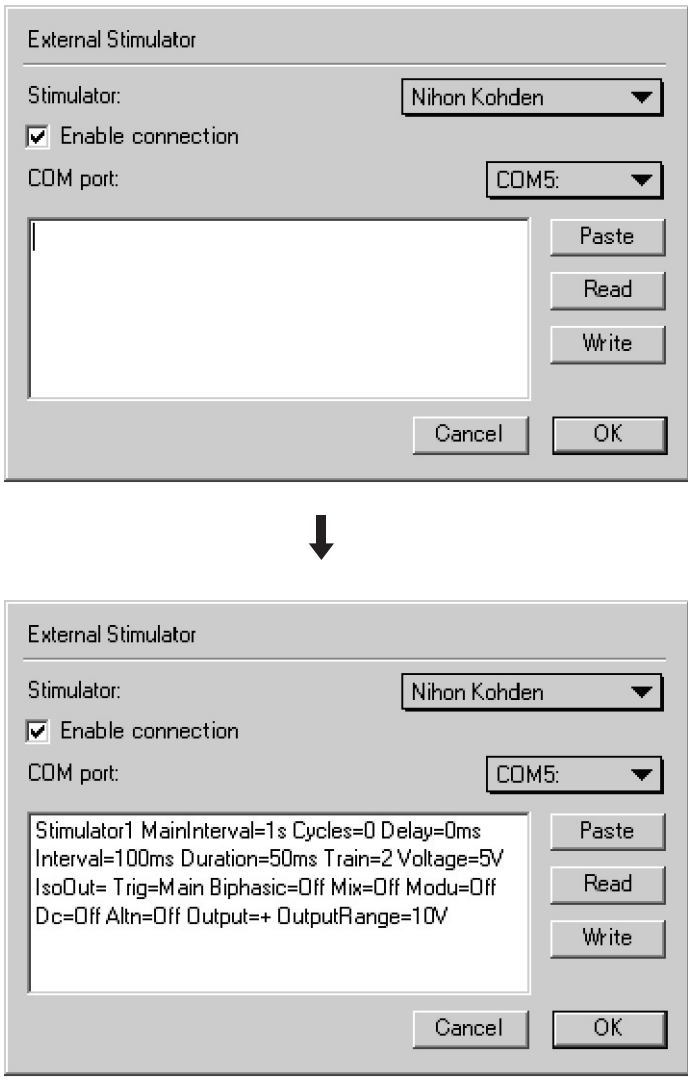
Click the Copy of the Edit menu to copy the selected condition.




3) Click the Preferences, and then click the External Stimulator in the Edit menu on the Scope Application. The External Stimulator window is opened.



4) Click the Paste button to the setting condition is put.




5) Confirm the setting condition is displayed, and then click the Write button.

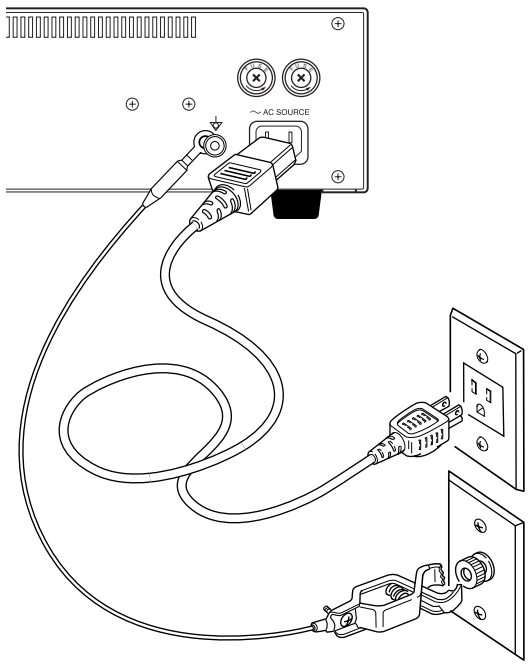
   The setting condition is set to the electronic stimulator.

## Installing the Stimulator

Take the following precautions when installing the stimulator.

1. Avoid contact with water or chemicals. Also, avoid direct contact with mist or humidified air from a humidifier as this may cause malfunction or reduce the service life of the stimulator.
2. Keep out of direct sunlight as this may result in an unexpected rise in temperature, causing malfunction or reducing the service life of the stimulator.
3. Make sure that the area is well ventilated. If the temperature inside the stimulator rises, it may cause malfunction or reduce the service life of the stimulator.
4. Do not place blankets or other objects on top of the stimulator.
5. Avoid placing in an area that is exposed to dust.
6. The power source must have sufficient capacity to supply the necessary power requirements of the stimulator. Reduced power resulting from insufficient capacity may affect the performance of the stimulator or activate the breaker, causing a power failure.
7. If any irregularity occurs when the power is turned on, turn the power off immediately and unplug the power cable from the power outlet. At the same time, mark the stimulator clearly as "Out of Order" and do not use it until it has been inspected and repaired.

## Connection of Cables




[Fig.29]

1. Ground wire
   Connect the supplied ground wire to the ground terminal and connect the other end to a reliable grounding conductor.
   - Avoid using water pipes as the grounding conductor as their grounding capability may not be reliable.
   - It is prohibited by law to use gas pipes as a grounding conductor.
2. Power cable
   Insert the supplied power cable with 3-pin plug into the power socket and insert the other end into an AC wall outlet.

> ⚠ CAUTION
>
> Always use the supplied 3-pin cable for the power cable.
> If any other power cable is used, it may result in an electric shock to the operator.

[Note] When the power cable with 3-pin plug is grounded in a 3-pin outlet with grounding electrode, the stimulator is automatically grounded. However, to prevent the effects of a broken ground wire inside the power cable, double grounding is recommended using the supplied ground wire.

3. When stimulating with the isolator, connect the isolator to the [to ISO] output connector.

[Note] • When connecting the isolator, tighten the screw firmly to prevent the cable from coming loose.
• When connecting the stimulation output cable, connect the cable securely to prevent it from coming loose.

4. If necessary, connect an oscilloscope and recorder and data acquisition/ analysis system, etc. as peripheral devices to measure and record phenomena after stimulation.

# Specifications

## Stimulation Trigger

Main Interval

(1) START
- A) MANUAL switch (front panel)
- B) START INPUT (rear)
  - Input pulse: +3.5 V or over, 10 μs or over
  - Input impedance: 10 kilohms or over
- C) Short-circuit of KEY terminal (rear) and E terminal

2) STOP
- A) MANUAL switch (front panel)
- B) STOP INPUT (rear)
  - Input pulse: +3.5 V or over, 10 μs or over
  - Input impedance: 10 kilohms and over

3) SET CYCLES
- Setting range: 1 ms to 9990 s, within ±0.1%
- Unit: ms, s
- Number: 3 digits

4) CYCLES
- Repeat count: 1 to 999
- Continuous stimulation: when set to “run”

5) External trigger
- TRIG LEVEL: 0 to +10 V continuous variable
  - Approx. 3 V when turned fully counterclockwise
- Input impedance: 100 kilohms or over

## Stimulation Waveform Setup

1) DELAY
- Setting range: 0 to 99.9 s, ±1%, within ±2 μs
- Unit: μs, ms, s
- Number: 3 digits

2) INTERVAL
- Setting range: 100 μ to 999s, within ±0.1%
- Unit: μs, ms, s
- Number: 3 digits

3) DURATION
- Setting range: 10 μ to 99.9 s, ±1%, within ±2 μs
- Unit: μs, ms, s
- Number: 3 digits

4) TRAIN

Setting range: 1 to 999

Continuous operation when set to “run”

## Stimulation Output

1) Output polarity and OFF

Polarity switch: Positive/negative polarity

(No effect on MODULATION or MIXING polarity)

OFF: No output to ISOLATOR or OUTPUT

2) MODULATION

Amplitude: Depends on amplitude of external signal including polarity (Max. ±10 V)

Linearity: within ±7% at ±1 V to ±10 V

Input impedance: 100 kilohms or over

No modulation in relation to MIXING waveform

3) MIXING

Mixing method: Analog addition

Mixing voltage range: 0 to ±10 V

(Voltage after mixing: max. ±10 V)

Linearity: within ±7% at ±1 V to ±10 V

Input impedance: 100 kilohms or over

4) DC

Output voltage: Direct current 0 to ±10 V

Direct current 0 to ±50 V when ±50 V output is selected

5) Isolator output (to ISO)

| | | |
|---|---|---|
| Pin: | 1, 2 | +15 V |
| | 3 | –15 V |
| | 4 | Signal output |
| | 5 | Range data |
| | 6 | E |
| | 7 | Range data synchronizing clock |
| | 8 | Void |
| | 9 | Void |
| | 10 | Void |

The fourth signal is not output fivefold when ±50 V output is selected. (±10 V)

6) Output

Linearity: 0 to ±1 V, within ±50 mV

Within ±1 V to ±10 V ±5%

Output impedance: 100 kilohms or less (at RL ≥ 2 kilohms)

Output waveform: 3 μs or less both rising and falling

Excessive deviation: 5% or less

7) ±50 V output

Linearity: 0 to ±5 V, within ±100 mV
±5 V to ±50 V, within ±5%

Output impedance: 10 ohms or less

Output waveform: 7 μs or less both rising and falling
Excessive deviation: 10% or less

Maximum output current: 400 mA or over

## Synchronized Output Signal

1) Output signal name

MAIN INTERVAL
SET CYCLES END
EXT TRIG
DELAY
INTERVAL
TRAIN END

2) Output signal

Amplitude: +5 V
Pulse width: approx. 500 μs
Rising: 3 μs or less
Output impedance: 1 kilohm or less

## Language

English

## Power Source

Voltage: AC 110 V, 220 V or 240 V ±10 %
(Changed voltage range by the connector)

Frequency: 50/60 Hz

Power input: 70 VA

## Environment

Main operating environment: Laboratory

### Operating Environment

Temperature: 10 to 40°C
Humidity: 30 to 90%
Atmospheric pressure: 70 to 106 kPa

### Storage Environment

Temperature: –20 to 60°C
Humidity: 10 to 95%
Atmospheric pressure: 70 to 106 kPa

## Durability

6 years (based on self-certification of company data)

## Installation

Indoor installation type

## Safety Standards

Applicable safety standards: IEC 60601-1
IEC 60601-1-2 :2001
Type of protection against electrical shock: Class I
Degree of protection against electrical shock where attached:
B applied parts
Degree of protection against harmful ingress or liquids:
IPX0 (devices w/o special protection)
Mode of operation: Continuous operation
Voltage endurance: AC 1500 V, 1 minute
Leakage current: 100 μA or less for both earth leakage and enclosure leakage
Insulation resistance: 50 megohms or over (DC 500 V)
Mechanical strength of stimulator: Compliant with impact NS7231-5.7, vibration NS7231-5.8

## Dimensions and Weight

Dimensions: 430 (W) x 98 (H) x 300 (D) mm
Weight: Approx. 8.3 kg

## Electromagnetic Compatibility

IEC 60601-1-2 :2001
EMC level (CISPR11) Class B

## Guidance and manufacture's declaration - electromagnetic emissions

This Model 1001 is intended for use in the electromagnetic environment specified below.

The customer or the user of the 1001 should assure that it is used in such an environment.

| Emissions test | Compliance | Electromagnetic environment guidance |
|---|---|---|
| RF emissions<br>CISPR 11 | Group 1 | The 1001 uses RF energy only for its internal function.<br>Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment. |
| RF emissions<br>CISPR 11 | Class B | The 1001 is suitable for use in all establishments,<br>including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes. |
| Harmonic emissions<br>IEC 61000-3-3 | Complies | |
| Voltage fluctuations/<br>flicker emissions<br>IEC 61000-3-3 | Complies | |

## Guidance and manufacture's declaration - electromagnetic immunity

This Model 1001 is intended for use in the electromagnetic environment specified below.

The customer or the user of the 1001 should assure that it is used in such an environment.

| Immunity test | IEC 60601 test level | Compliance level | Electromagnetic environment -Guidance |
|---|---|---|---|
| Electrodatic discharge (ESD)<br>IEC 61000-4-2 | ±6 kV contact<br>±8 kV air | ±6 kV contact<br>±8 kV air | Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%. |
| Electrical fast transient/ burst<br>IEC 61000-4-4 | ±2 kV for power supply lines | ±2 kV for power supply lines | Mains power quality should be that of a typical commercial or hospital environment. |
| Surge<br>IEC 61000-4-5 | ±1 kV differential mode<br>±2 kV common mode | ±1 kV differential mode<br>±2 kV common mode | Mains power quality should be that of a typical commercial or hospital environment. |
| Voltage dips, short interruptions and voltage variations on power supply input lines<br>IEC 61000-4-11 | <5% *Ut* (>95% dip in *Ut*) for 0.5 cycle<br><br>40% *Ut* (60% dip in *Ut*) for 5 cycles<br><br>70% *Ut* (30% dip in *Ut*) for 25 cycles<br><br><5% *Ut* (>95% dip in *Ut*) for 5s | <5% *Ut* (>95% dip in *Ut*) for 0.5 cycle<br><br>40% *Ut* (60% dip in *Ut*) for 5 cycles<br><br>70% *Ut* (30% dip in *Ut*) for 25 cycles<br><br><5% *Ut* (>95% dip in *Ut*) for 5s | Mains power quality should be that of a typical commercial or hospital environment.<br>If the user of the 1001 requires continued operation during power mains interruptions, it is recommended that the 1001 be powered from an uninterruptible power supply or a battery. |
| Power frequency (50/60 Hz) magnetic field<br>IEC 61000-4-8 | 3 A/m | 3 A/m | Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment. |
| NOTE: Ut is the AC mains voltage prior to application of the test level. | | | |

## Guidance and manufacture's declaration - electromagnetic immunity

This Model 1001 is intended for use in the electromagnetic environment specified below.

The customer or the user of the 1001 should assure that it is used in such an environment.

| Immunity test | IEC 60601 test level | Compliance level | Electromagnetic environment - guidance |
|---|---|---|---|
| | | | Portable and mobile RF communications equipment should be used no closer to any part of the 1001, including cables, than the recommended separation distance caluculated from the epuation applicable to the frequency of the transmitter.<br>Recommended separation distance |
| Conducted RF<br>IEC 61000-4-6 | 3 Vrms<br>150 kHz to 80 MHz | 3 Vrms<br>150 kHz to 80 MHz | $d = 1.2\sqrt{P}$ |
| Radiated RF<br>IEC 61000-4-3 | 3 V/m<br>80 MHz to 2.5 GHz | 3 V/m<br>80 MHz to 2.5 GHz | $d = 1.2\sqrt{P}$ 80 MHz to 800 MHz<br>$d = 2.3\sqrt{P}$ 800 MHz to 2.5 GHz<br>where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufactuer and d is the recommended separation distance in meters (m).<br>Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey*1, should be less than the compliance level in each frequency range*2.<br>Interference may occur in the vicinity of equipment |

NOTE1: At 80 MHz and 800 MHz, the higher frequency range applies.

NOTE2: These quidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

*1 Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey shoule be considered. If the measured field strength in the location in which the 1001 is used exceeds the applicable RF compliance level above, the 1001 should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the 1001.

*2 Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

## Recommended separation distances between portable and mobile RF communications equipment and the 1001

This Model 1001 is intended for use in the electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the 1101 can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the 1001 as recommended below, according to the maximum output power of the communications.

| Rated maximum output power of transmitter (W) | Separation distance according to frequency of transmitter (m) | | |
|---|---|---|---|
| | 150 kHz to 80 MHz<br>$d = 1.2\sqrt{P}$ | 80 MHz to 800 MHz<br>$d = 1.2\sqrt{P}$ | 800 MHz to 2.5 GHz<br>$d = 2.3\sqrt{P}$ |
| 0.01 | 0.12 | 0.12 | 0.23 |
| 0.1 | 0.38 | 0.38 | 0.72 |
| 1 | 1.2 | 1.2 | 2.3 |
| 10 | 3.8 | 3.8 | 7.2 |
| 100 | 12 | 12 | 23 |

For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufactuer.

NOTE1 At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.
NOTE2 These gudelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

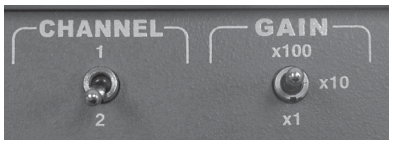
## System Composition for EMC test

This 1001 is tested to comply with IEC 60601-1-2 :2001 with the following composition. If any part which is not specified by our company is used, the EMC specifications might not be satisfied.

| Units | Cable length |
|---|---|
| 1001 Electronic stimulator | ——— |
| Output Code (12pc) | 2 m |
| USB Code | 2 m |

# Controls and Connectors

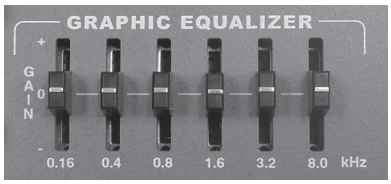
**INPUT:** Signals to be processed are connected to the Audio Monitor at these two BNC jacks (**Ch. 1** and **Ch. 2**).



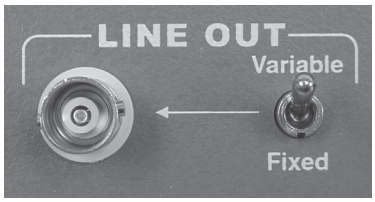

**CHANNEL:** This toggle switch determines which of the two input signals will be processed.

**GAIN:** This three position switch controls the level of signal gain. The switch allows the user to select from **X1**, **X10**, or **X100** gain.

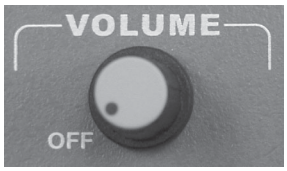
**NOTCH FILTER:** In the ON position, this filter will attenuate line noise (Either 50 or 60 Hz, depending on the country of use).



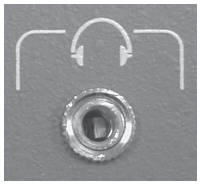

**GRAPHIC EQUALIZER:** These 6 slide potentiometers adjust the gain of a narrow range of frequencies. Each slide potentiometer can boost/increase (**+**) or attenuate/decrease (**-**) the gain around the center frequency indicated (160Hz, 400Hz, 800Hz, 1.6kHz, 3.2kHz, and 8.0kHz) by 12dB.




**LINE OUT:** This BNC connector provides the output signal from the amplifier channel. The toggle switch determines if this signal is *FIXED* in gain relative to the input signal (at the level determined by the **GAIN** toggle switch or includes the *VARIABLE* amplification provided by the **GRAPHIC EQUALIZER AND VOLUME** control.




**VOLUME:** This potentiometer adjusts the output volume of the speaker, and the variable amplification to the processed signal. *Warning: It is recommended to turn this knob to the off position before attaching an input signal to the Audio Monitor, in order to prevent damage to the speaker, and any nearby eardrums.*



**HEADPHONES JACK:** Insertion of a mini-headphones plug into this jack will disable the internal speaker, and power the user supplied headphones.

# Operating Instructions

## Typical Set-Up Procedure

*Turn the **VOLUME** control to the off position prior to connecting an input signal to either of the two input channels in order to prevent damage to the internal speaker or any nearby eardrums.*

Using the Channel Switch, select the desired input signal channel to be amplified. Determine the gain setting. Start with the lowest **GAIN** setting possible, and slowly increase the **VOLUME** control until a desired audio level is obtained. If you reach the maximum setting on the **VOLUME** control and the signal is still too quiet, return the **VOLUME** control to the off position and increase the **GAIN** to the next greater level.

If you would like to minimize power line generated noise, switch the **NOTCH** filter to *On*.

Adjust the **GRAPHIC EQUALIZER** slide knobs to increase or decrease the gain of certain frequency ranges in order to produce a more pleasing audio sound.

# Theory of Operation

One of two inputs may be selected using the **CHANNEL** switch. The selected input is then amplified according to the setting of the **GAIN** switch. After amplification, the signal can be filtered at the frequency of the power line by use of the **NOTCH** filter.

Particular narrow ranges of frequencies of the processed signal can then be boosted or attenuated using the **GRAPHIC EQUALIZER**. Maximum boost or attenuation is +/- 12dB, centered on the frequency indicated under each slide knob.

The output of the graphic equalizer feeds directly into the **VOLUME** control and **LINE OUT**put. Setting the **LINE OUT** Switch to *Variable* will produce the processed signal with the additional variable gain provided by the **VOLUME** control at the BNC jack. Setting the **LINE OUT** Switch to *Fixed* will provide the processed signal at the gain indicated by the **GAIN** switch (taken prior to the **GRAPHIC EQUALIZER**) at the BNC output jack.

The signal is then amplified using a power amplifier circuit in order to provide enough current to drive either the internal speaker or an external user-supplied set of headphones. Inserting a mini-headphones plug into the headphones jack will disable the internal speaker.

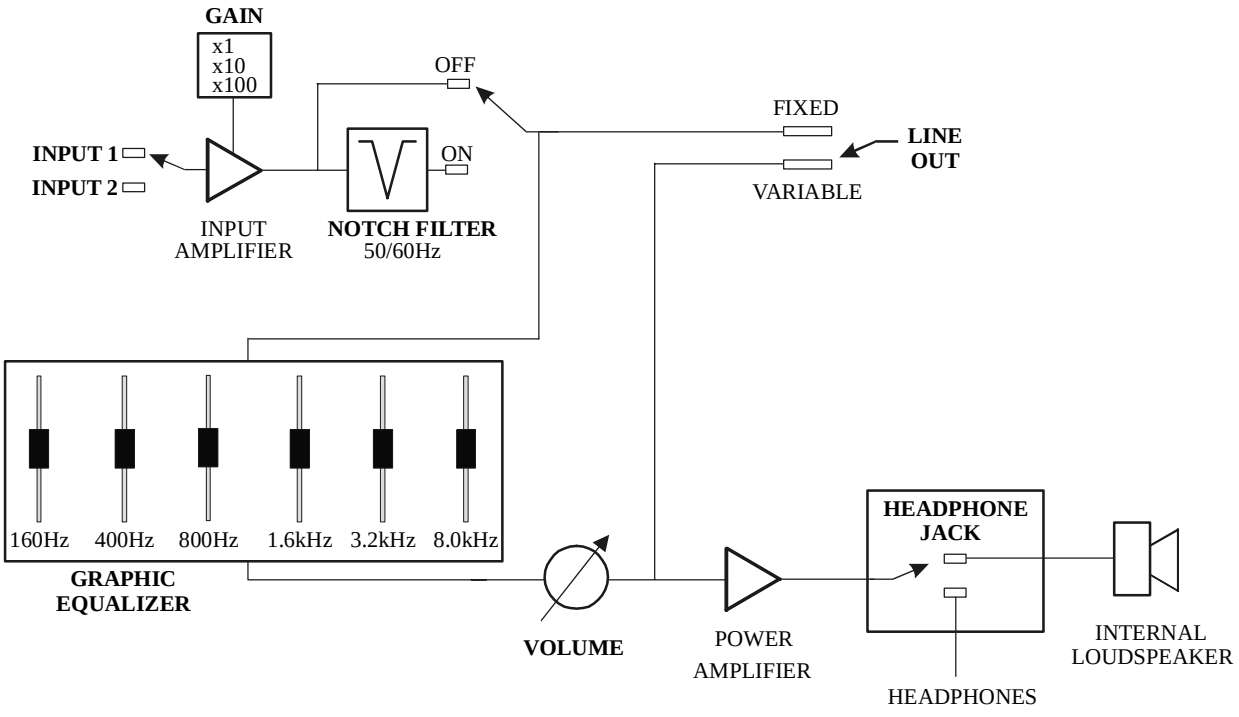



Figure 1. Main circuit block diagram

# Specifications

## Amplifier

**Gain:** 1V/V, 10V/V, 100V/V (+40dB)

**Sensitivity:** 0.01V p-p

**Input resistance:** 20MΩ

**Maximum input before LINE OUT clips:**

| | |
|---|---|
| GAIN: x1 | 10.0V |
| GAIN: x10 | 1.0V |
| GAIN: x100 | 0.1V |

**Maximum input before SPEAKER clips** *(with volume control fully clockwise)***:**

| | |
|---|---|
| GAIN: x1 | 1.0V |
| GAIN: x10 | 0.1V |
| GAIN: x100 | 0.01V |

**Noise** *(At Fixed Line Out)*

470Ω source resistance (not shorted input)

| | |
|---|---|
| 22Hz-22kHz: | 14µV p-p (57dB signal to noise) |
| 1kHz spot frequency: | 3µV p-p (70dB signal to noise) |

2,200pF source capacitance to emulate a crystal/ceramic transducer source

| | |
|---|---|
| Without NOTCH Filter (22Hz-22kHz): | 220µV p-p (33dB signal to noise) |
| With NOTCH Filter (22Hz-22kHz): | 28µV p-p (51dB signal to noise) |
| 1kHz spot frequency: | 1µV p-p (80dB signal to noise) |

**Notch Filter**

| | |
|---|---|
| Gain: | Unity (0dB) |
| Notch Frequency: | 60Hz (50Hz in specific countries) |
| Notch Depth: | -29dB |

**Graphic Equalizer**

| | |
|---|---|
| Gain: | Unity (0dB) |
| Boost/Cut Frequencies (Hz): | 160, 400, 800, 1600, 3200, 8000 |
| Nominal Boost & Cut: | +/- 10dB (within 1dB) |

**Power Amplifier**

| | |
|---|---|
| Power output: | 2.7W continuous (rms) sine wave into 4Ω<br>5.4W continuous (peak) sine wave into 4Ω |
| Distortion (THD+N): | <0.3%, 80Hz - 16kHz (at rated power) |

# Specifications

**Power Amplifier (continued)**

| | |
|---|---|
| Frequency response: | 100Hz - 26kHz, -3dB points (470µf output capacitor) |
| Amplification | x10 |

## Physical Dimensions

| | |
|---|---|
| Width | 8.5 inches (22 cm) |
| Height | 4.25 inches (11 cm) |
| Depth | 2.5 inches (7 cm) |
| Weight | 4 lbs. |

# Warranty and Service

### What does this warranty cover?

A-M Systems, Inc. warrants to the Purchaser that the Instrument, excluding cables, Headstage Probes and any other accessories shipped with the Instrument, (hereafter the "hardware") is free from defects in workmanship or material under normal use and service for the period of one (1) year. This warranty commences on the date of delivery of the hardware to the Purchaser.

### What are the obligations of A-M Systems, Inc. under this warranty?

During the warranty period, A-M Systems, Inc. agrees to repair or replace, at its sole option, without charge to the Purchaser, any defective component part of the hardware. To obtain warranty service, the Purchaser must return the hardware to A-M Systems, Inc. or an authorized A-M Systems, Inc. distributor in an adequate shipping container. Any postage, shipping and insurance charges incurred in shipping the hardware to A-M Systems, Inc. must be prepaid by the Purchaser and all risk for the hardware shall remain with purchaser until such time as A-M Systems, Inc. takes receipt of the hardware. Upon receipt, A-M Systems, Inc. will promptly repair or replace the defective unit, and then return the hardware to the Purchaser, postage, shipping, and insurance prepaid. A-M Systems, Inc. may use reconditioned or like new parts or units at its sole option, when repairing any hardware. Repaired products shall carry the same amount of outstanding warranty as from original purchase, or ninety (90) days which ever is greater. Any claim under the warranty must include a dated proof of purchase of the hardware covered by this warranty. In any event, A-M Systems, Inc. liability for defective hardware is limited to repairing or replacing the hardware.

### What is not covered by this warranty?

This warranty is contingent upon proper use and maintenance of the hardware by the Purchaser and does not cover batteries. Neglect, misuse whether intentional or otherwise, tampering with or altering the hardware, damage caused by accident, damage caused by unusual physical, electrical, chemical, or electromechanical stress, damage caused by failure of electrical power, or damage caused during transportation are not covered by this warranty. **Products may not be returned to A-M Systems, Inc. for service, whether under warranty or otherwise, which are contaminated by infectious agents, radioactive compounds or other materials constituting a health hazard to employees of A-M Systems, Inc.**

### What are the limits of liability for A-M Systems, Inc. under this warranty?

A-M Systems, Inc. shall not be liable for loss of data, profits or savings, or any special, incidental, consequential, indirect or other similar damages arising from breach of contract, negligence, or other legal action even if the company or its agent has been advised of the possibility of such damages, or for any claim brought against you by another party. **THIS EQUIPMENT IS NOT INTENDED FOR CLINICAL MEASUREMENTS USING HUMAN SUBJECTS. A-M SYSTEMS, INC. DOES NOT ASSUME RESPONSIBILITY FOR INJURY OR DAMAGE DUE TO MISUSE OF THIS EQUIPMENT**. Jurisdictions vary with regard to the enforceability of provisions excluding or limiting liability for incidental or consequential damages. Check the provision of your local jurisdiction to find out whether the above exclusion applies to you.

This warranty allocates risks of product failure between the Purchaser and A-M Systems, Inc. A-M Systems, Inc. hardware pricing reflects this allocation of risk and the limitations of liability contained in this warranty. The warranty set forth above is in lieu of all other express warranties, whether oral or written. The agents, employees, distributors, and dealers of A-M Systems, Inc. are not authorized to make modifications to this warranty, or additional warranties binding on the company. Accordingly, additional statements such as dealer advertising or presentations, whether oral or written, do not constitute warranties by A-M Systems, Inc. and should not be relied upon. This warranty gives you specific legal rights. You may also have other rights which vary from one jurisdiction to another.